EXCAVATIONS AT HOT WATER BEACH (N44/69), COROMANDEL PENINSULA

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Abstract. Salvage excavations, carried out in 1969 on a beach midden site, produced a considerable amount of bone, shell and artifactual material, together with carbon 14 dates and a well defined Loisels pumice horizon. There were three main layers, one of which was associated with the Loisels pumice.

Hot Water Beach is situated on the east coast of the Coromandel Peninsula, about 19 km south-east of Whitianga (Figs. 1, 2).

The coarse yellow sand beach drops fairly steeply to the sea along most of its 1.6 km length. It may be divided into two main areas. The longer north-western portion of the beach is backed by dunes which separate the coast from the low lying swampy area stretching for several kilometres inland. A shallow sandy stream at the northern end drains this swamp. The shorter south-eastern section is separated from the northern end by a promontory which juts out into the beach and against which the water laps at high tide. Below this promontory the hot springs, from which the beach gets its name, bubble up through the sand at low tide. On the east side of the promontory another stream flows out to sea. It is deeper and faster flowing than the northern one and, although it is superficially sandy, its base consists of large water-worn stones. These continue to the east end to form a boulder beach. This stream has a different watershed and rises in hills rather than a swamp. On the promontory is a headland pa (N44/14). The cliffs surrounding the pa are still covered by remnants of coastal forest. It is on the sandy flats across the stream from the pa that the site (N44/69) is situated. These flats stretch back 200 or 300 m to where the edge of the hills rise steeply to the top of the ridge.

Hot Water Beach lies at what could be considered to be the southern boundary of a discrete territorial area. To the north is the deep indentation of Mercury Bay, on the west are the reaches of the Whitianga Harbour and its tidal estuaries, and the southern boundary is formed by the Whenuakite River valley. These natural features surround a block of hilly land and ridges, which is divided into two equal parts by the Purangi River. The western block, whose northern end forms Cook's Beach, has little flat land, but the eastern and more coastal area has a series of low hills and ridges divided by streams and small valleys.

South of the Whenuakite valley and Hot Water Beach the country becomes very rugged and mountainous as far as the Tairua Harbour some 12 km (8 miles) south in a direct line.

Within this area of about 25 km^2 (10 square miles) are found islands, rocky coasts, ocean beaches, tidal estuaries, river flats, sources of stone and forests. Obsidian is found south of Cook's Bay and the rivers contain boulders of quartz, chert and other siliceous

Fig. 1. Location map, Hot Water Beach and surrounding area.

Fig. 2. General view of site N44/69 showing eastern stream beach and hot spring area below promontory at upper left.

material. All these economic necessities are within about a 12 km (8 mile) radius of the site which is on the southern extremity of this very rich area.

The only recorded source of basalt in the vicinity is the Tahanga Quarry (N40/8) at Opito Beach which lies to the north just outside the area being described. However, it would be an easy journey by sea to Tahanga to collect or trade this adze and flake material.

The Excavation

Early in 1969 Mrs A. McCartney of Hamilton drew the attention of the Auckland Museum to a site at Hot Water Beach. She had found artifactual material in the eroding dunes near the beach access road, investigated the area and established that the material was coming from two main layers, a lower yellow sand layer and above that a black greasy charcoal one. Amongst the material recovered were bone and dentalium reel units and a side-hafted adze.

In July 1969, Janet Davidson, Mrs McCartney and I spent a day at the site and put down a trial excavation. Five layers were established at that time.

In August 1969, a group under the auspices of the Auckland Museum spent a week working there.

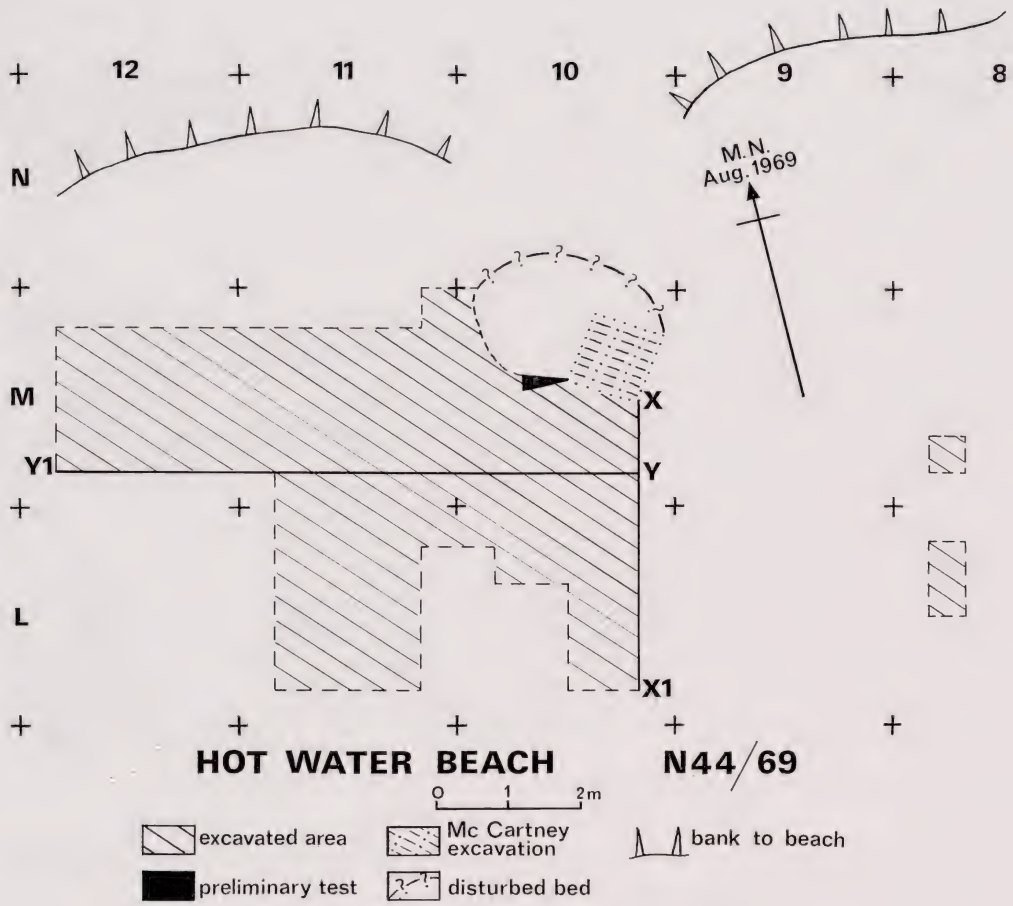

Fig. 3. Ground plan of excavated area N44/69.

A datum peg was established at X 1 (Fig. 3) and base-line X 1 — X was laid down in an approximately north - south line (a plan relating the position of the excavation to present survey pegs is on file in the Auckland Museum). A second base-line Y — Y 1 at right angles, 3 m north of X 1, established the east - west line. From these, 3 m squares were set out. Letters were assigned for the north-south lines and numbers for the east-west lines (Fig. 3, cross-sections Figs. 4, 5). Squares M 10, M 11, and L 10 were lined out as 2 m squares with 50 cm baulks. These were excavated first and as work progressed, squares M 12 and finally L 11 were investigated. Four 2 m squares, M 10, M 11, M 12, and L 11 were completed, but only a portion of square L 10 was fully excavated. All excavated material was sieved through a one-third inch mesh and a limited amount of sorting done at that stage. In squares M 10 and L 10 large stones, large pieces of pumice and broken shells were checked and if not artifacts were discarded. Later all sieved material except large stones was bagged for subsequent sorting.

Although the weather was fine and fairly windless, the drying out and collapsing of the sandy baulks was a constant problem so that the squares, as soon as they had

been completed, were photographed, sections drawn and then partially filled in wherever it was possible. This meant that the whole site was never exposed completely at one time. However, the base-line X — X 1 (Figs. 3, 5, 6) remained exposed as a control throughout the excavation.

The area dug in each square was:

Square M 10	—	4.5 m^2
Square L 10	—	4.25 m^2
Square M 11	—	7.5 m^2
Square L 11	—	5.25 m^2
Square M 12	—	5.0 m^2

As work progressed, six layers were finally identified, five of which were practically continuous over the whole area dug while one, layer 6, was found in pockets below layer 5. Of these six layers, four were occupation layers but layer 6 produced a very small amount of cultural material compared with the other three occupation layers. The pockets of layer 6 rested on sterile beach sand, which in turn covered a ground base of large water-worn stones; probably a continuation of the north-eastern boulder beach. These boulders were uncovered in squares M 10 and L 10, but as the work progressed, excavation was not continued below the sterile sand.

It is not known how far the site extended seawards. Flooding of the stream could have caused its mouth to swing westwards to the base of the promontory, or

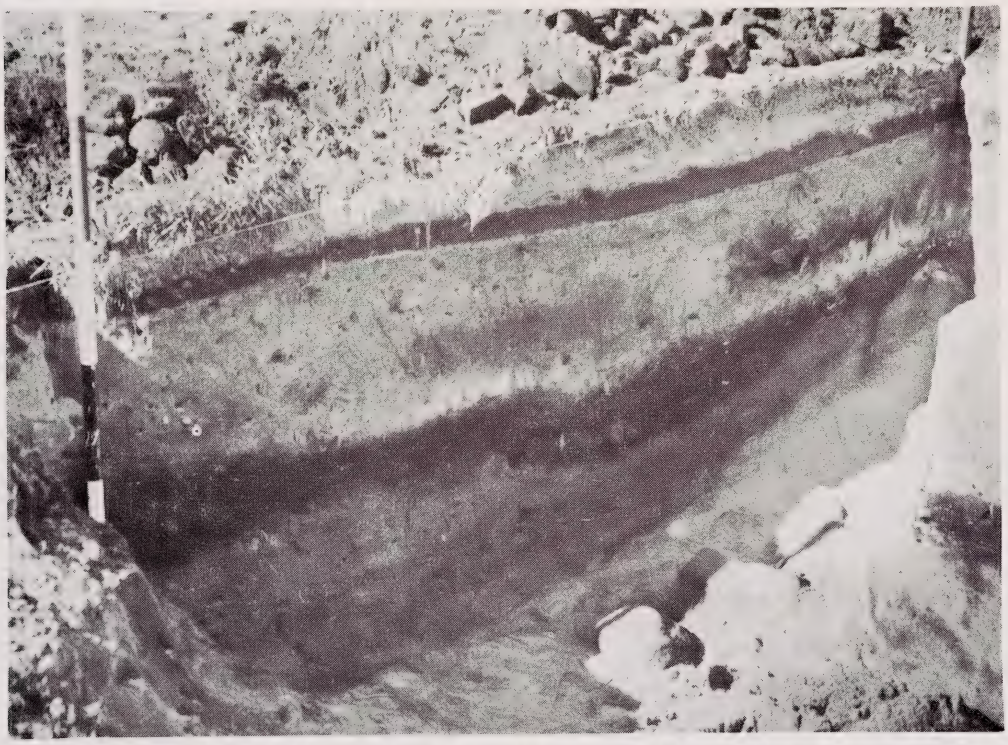

Fig. 6. Photo of baseline baulk X — X 1 Squares M 10, L 10 East Baulk.

east to where the boulder beach is exposed. The deposits of cultural material seemed to be at their maximum in the M 10 and M 11 area, suggesting that the stream edge was further north formerly than it is now, and that possibly the central area of layer 6 and the seaward portion of layers 5 and 4 had been eroded away by stream bed changes. All the layers except layer 6 had been affected by the use of this part of the beach for motor access to the water, and a large part of the north side of the site had been disturbed by fossicking (Fig. 3).

In general all layers tended to be fairly even in their distribution but showed a gradual thinning towards the west of the site.

An estimate was made of the volume of each layer dug (see below, p. 53) and the following cultural layers presented these volumes:

Layer 3b — 4.505 m^3
Layer 4 — 3.701 m^3
Layer 5 — 4.081 m^3
Layer 6 — not estimated

A portion of square M 10 had been fossicked north and east of the McCartney excavation. This disturbed material was removed, sieved and bagged, as a considerable amount of cultural material was present. The fill from the McCartney and preliminary test digs was also removed, where present in the square, until the unexcavated face was established and work proceeded from there.

Although the cultural material from the disturbed area could be assigned to no layer, it seems reasonable to assume that the disturbed cultural material could be associated with layers 4 and 5, as layers 6 and 3b were present only at the south end of square M 10.

Two test areas were dug eastwards of the baulk line X — X 1 to try to establish what layers were present where the land rose gradually towards the ridge. A 50 cm pit was dug in the south-west corner of square M 8 and a 50 cm x 1 m trench was placed along the west side of square L 8.

STRATIGRAPHY AND FEATURES

Layer 1

This was recent wind-blown sand covering the area unevenly. It supported a heavy growth of lupin and weeds along the area between the beach and the present camping ground. On the road access portion of the site, mainly over squares M 10 and L 10, it was barely present.

Layer 2

This was almost continuous over the excavated area except where it had been worn away by traffic on the access road and at one point where it had been cut through. This was in the unexcavated eastern baulk of square L 11 and the corner just protruded into square L 11. This cut removed a small portion of layer 2 in the south-eastern area of a pit in layer 3b. However, the main surface of the pit was

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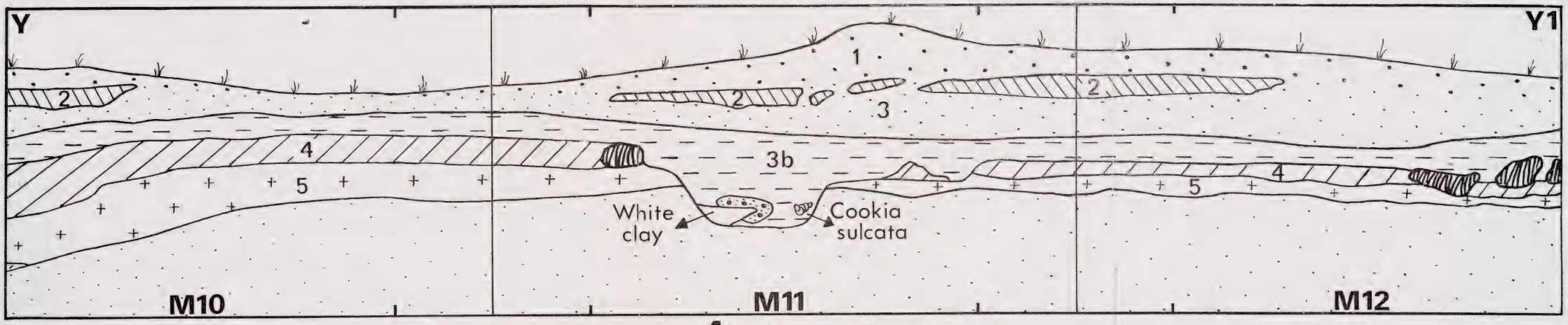
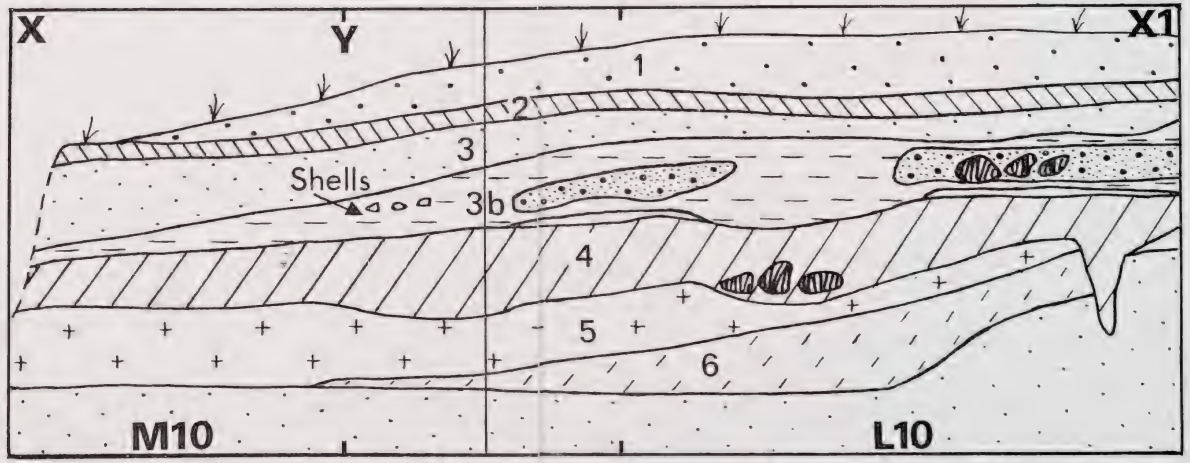


4

surface sand & grass
charcoal & sand
yellow sand
consolidated charcoal & sand
white sand
yellow-gray sand
sterile sand
haangi stones
gray-yellow sand
greasy charcoal & sand

HOT WATER BEACH
N44/69

0 1m



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Figs. 4, 5. 4. Cross-section Y — Y 1 Squares M 10, M. 11, M 12 South Baulk. 5, Cross-section X — X 1 Squares M 10, L 10 East Baulk.

covered by undisturbed layer 2 material and clearly sealed it. Layer 2 was a distinctive sterile layer of browny-black consolidated sandy material of an almost constant thickness (8-10 cm). Its formation was probably due to the deposit of water-washed earth and charcoal from the burning off of bush and early farming activities.

Layer 3 and 3b

These were considered to be one sterile layer during the preliminary excavation and the initial excavation of square M 10. Towards the M 10-L 10 baulk it became apparent that cultural material was beginning to occur in the lower level of layer 3. There were occasional thin lenses of sterile sand resting on the hard pan of layer 4, between the cultural material of layer 3b and layer 4, which suggested that the site had been abandoned at the end of the layer 4 occupation but not for long enough to build up any depth of sterile deposit. The consolidated nature of layer 4 would soon form a surface from which sterile blown sand would be dispersed or stamped down by human activity.

Although the activity of this layer was probably peripheral to the main cultural centre, it was sufficient to leave a residue of midden material, a few features, and artifacts. The build up of the sterile upper portion, layer 3, probably started before the final abandonment of the site, as layer 3b merged imperceptibly with layer 3 and was finally sealed by layer 2.

The 3b cultural layer thinned out in the site to the north as it neared the sea and layer 3 thickened and took its place.

Feature 1 (Fig. 7) was a hangi which measured 75 cm across, with the stones more numerous on the west than on the east side. It shows in the baulk (Figs. 5, 6).

Feature 2 was another hangi, 60 cm across, part of which entered the baulk (Figs. 5, 6). Both were interspersed with greasy black sand and charcoal.

Feature 3 was a very eroded pit cutting across in a north-west south-east direction and measuring approximately 3.5 x 2.5 m. The bulk of this feature was situated in square L 11 with just the northern tip appearing in square M 11 (Figs. 4, 7). It was 114 cm below datum at the M 11 end and deepened slightly at the square L 11 end to 120 cm below datum. It cut through layers 4 and 5 and its floor was cut into the sterile yellow sand of the natural beach. It was filled with a dark grey layer of sand mixed with assorted midden material including several pieces of moa bone, one-piece fish-hook pieces and shell as well as other material. On the north-east side of the pit wall in the M 11 area was a lump of clay in the fill, which could have been similar to that of feature 15 in layer 4, although it was rather whiter in colour. Above and extending further into the fill was a layer of sand and charcoal which could also be of similar composition to that of layer 4. This suggests that the pit was filled in deliberately and that layer 4 material may have been used for part of the fill. The rest of the fill was composed of a greyish-yellow sand. There was considerable breakdown of the sides of the pit owing to the unstable nature of the sand, but it did not give the impression that it had been exposed to the elements for any length of time in the deeper portions. Along the north-east side of the pit there was some

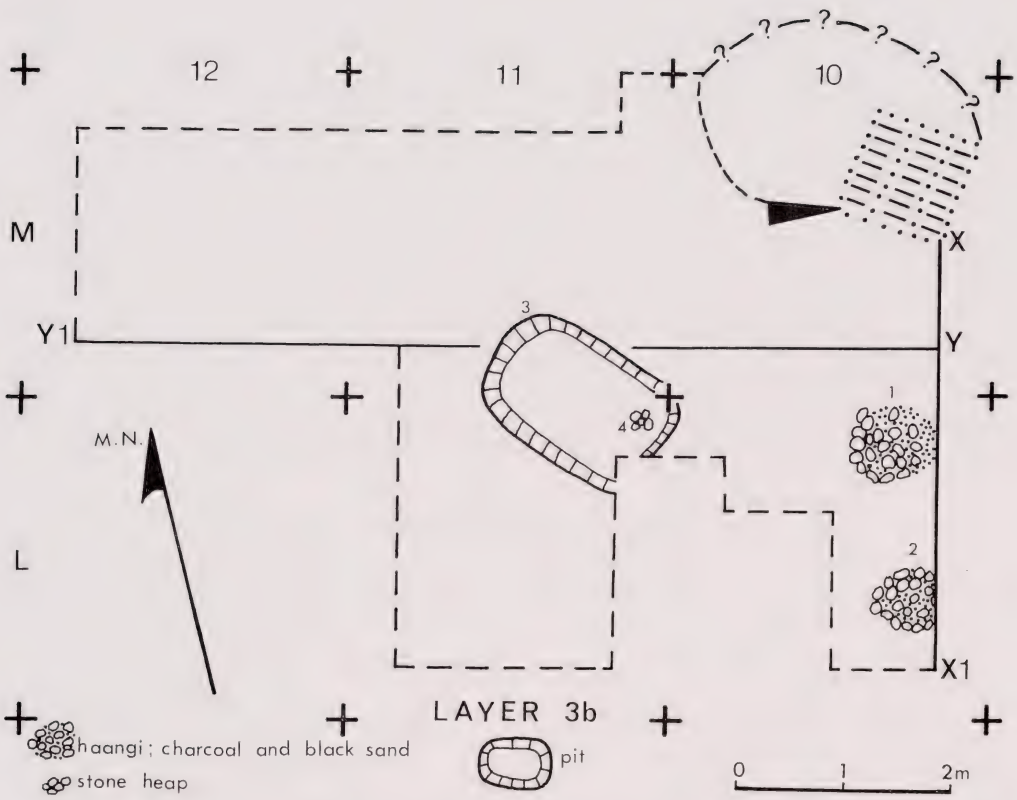


Fig. 7. Floor plan, Layer 3b, N44/69.

suggestion of a ledge which angled towards the straight edge of hangi 13 in layer 4 (Fig. 8). This might have supported a covering which rested against the hangi stones, but the ledge was not continuous and may have been caused by weathering of the upper section.

Feature 4 was a small pile of five stones on the floor of the pit at the south-east end. They seem to have been stacked rather than to have fallen in. There were no post holes in the floor of the pit and none surrounding it.

Layer 4

This was a black compact "greasy" layer averaging about 14 cm in thickness, but the "greasy" component became less evident as the layer thinned out to a grey-black, less consolidated, sandy material near the west side of the site. Scattered throughout the layer were a considerable number of blackened stones, presumably used as hangi stones. Some of the large heaps contained stones of 20 cm or more in diameter. These were similar to the stream and boulder beach ones, found locally.

A considerable amount of midden and artifactual material, much of it blackened by fire, was present. Squares M 10 and L 10 contained a large proportion of material

which was charred. The cultural material was similar to that of layer 5 but in reduced quantities.

Evidence for structures was found in this layer (Fig. 8). There were two apparent groupings of post holes and several scattered ones. Holes 2, 3 and 4 seemed associated with a hangi area and holes 16, 17, 19 and 20 could have been related to the firepit-hangi 18 or have a different purpose such as part of a shelter or house.

Post hole 1 was found during the preliminary test in July (Fig. 3). It was cut from layer 4 and through layer 5 to the sterile sand below. It was 154 cm below datum at its pointed base (all the depths and widths are approximate because of the problem of excavating in sand). It was filled with a grey-black sand.

Post holes 2, 3 and 4 originated from layer 4 and cut through layer 5 to sterile sand. They all had pointed bases and were filled with grey-black sand. Their depth was 140 cm below datum, and diameter 16 cm. These post holes followed a slightly curved east-west alignment.

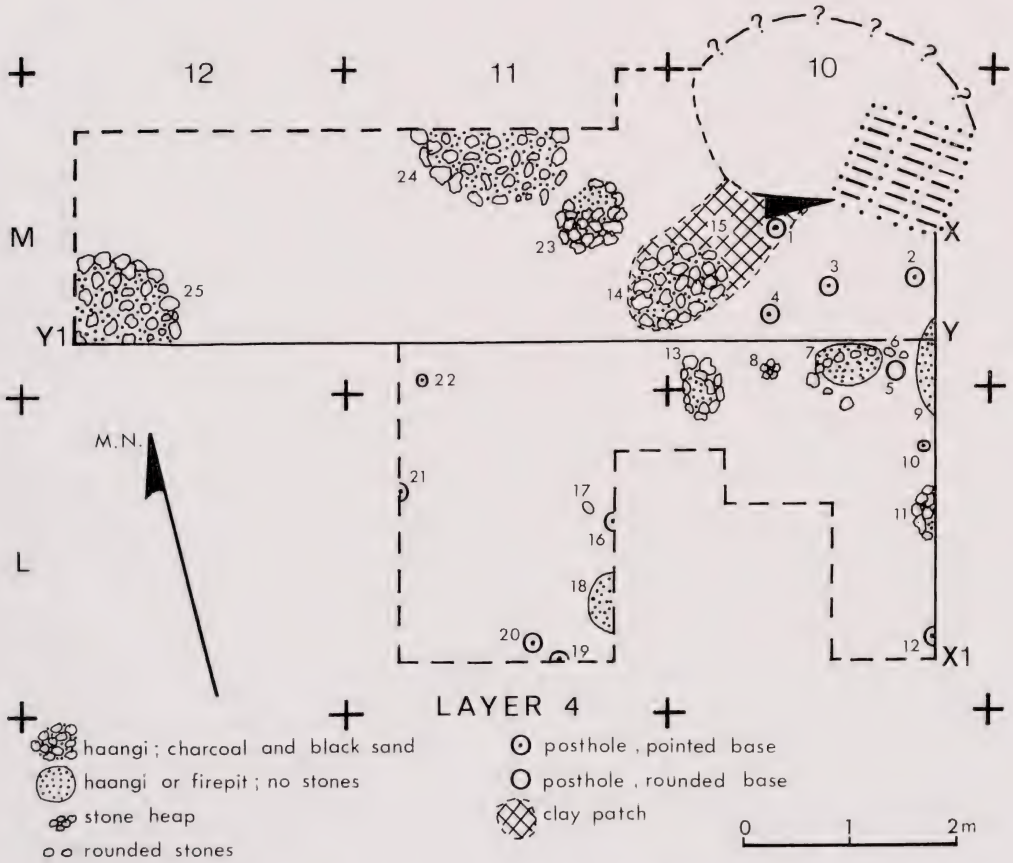


Fig. 8. Floor plan, Layer 4, N44/69.

Post hole 5 was situated at the east end of a semi-circle of stones, the most eastern two of which curved round the north side of the hole. It originated in layer 4, was filled with coarse yellow sand and just cut through into layer 5. It was 20 cm across, 120 cm below datum and had a rounded base.

The stone alignment, feature 6, formed a semi-circle that ended just before the baulk line M 10/L 10 and was made up of single large rounded stones. Two other flattish angular stones were found in the L 10 baulk. These seem to have been part of the semi-circle though they did not abut against it and were slightly in from the line of it. Immediately below the stone semi-circle was a fire pit or hangi (Feature 7), which contained no stones and had apparently been filled in or levelled to form the base for the stone alignment, as it seemed to rest on a fairly consolidated flat area, and the stones had been placed neatly on the top. Post hole 5 marked the end of the consolidated area on the east side, and, as the end of the stones enclosed the north side of it, would seem to be part of the feature.

Feature 8 was a small heaped up collection of stones.

Feature 9 was part of a hangi pit dug from layer 4 into layer 5. It contained no stones in the area excavated, up to where it disappeared into the baulk.

Post hole 10 had a pointed base and was situated just inside the eastern baulk line in square L 10. It was 14 cm in diameter and ended 120 cm below datum, in layer 5. It was filled with a dark grey sand and was dug from layer 4.

Feature 11 consisted of a hangi pit containing numerous stones. This measured 60 cm across where it entered the east baulk of square L 10.

Feature 12 was a post or large stake hole at the south end of the east side of square L 10. Its point measured 120 cm below datum and it was rather funnel shaped at the top where it measured 20-25 cm across. The north side of the hole was higher than the south. It was at this large post hole that layer 6 ended (this hole dug into the top of the small dune bank menioned in layer 6) (Figs. 5, 6) and layer 5 had been removed so that it was not present immediately behind the post. Instead there was a patch of clean white sand which appeared to merge into a thin layer of layer 5 which thickened some 30 cm back. The interpretation of this post hole and the layering immediately behind it was complicated by the fact that the outer edge only of the hole appeared in the baulk and it was situated about 20 cm before the unexcavated baulk corner of the square where the excavation turned at right angles away from the hole.

Feature 13 was a hangi 60 cm across (north/south) with an area in the centre free of stones containing blackened greasy sand and charcoal of a more concentrated type than that of the surrounding layer. It was situated on the east side of the layer 3b pit and as the west side of the stones seemed to follow a straight line rather than a curved one it is possible that the pit had been cut through the edge of the hangi and the stones removed. An alternative is that the hangi might have had a straightish edge originally because the pit edge did not extend right to the edge of the stones, and because the sandy black of the hangi interior did not show in the very eroded edge of the pit.

Feature 14 consisted of a large stone heap and hangi pit interspersed with consolidated greasy sand and charcoal. Feature 15 situated beneath it and extending to the north-east and beyond the July test area was a compact layer of yellow sandy clay. It appeared to line the hangi and be compressed into, rather than be part of, layer 5. There were some shells scattered through it. A similar type of deposit was found at Site N30/5, square B, upper layer (Law 1972, p. 84).

Post hole 16 was a pointed post hole 120 cm below datum at its base and 14 cm in diameter. It was dug from layer 4 and filled with a grey black sand.

Feature 17 was a narrow slot dug through layer 5 into natural sand. The surrounding sand was rather stained or had organic material in it, forming a less dark patch around the slot than the fill material but had no definite edge. The slot was slightly angled towards post hole 16 and may have been a supporting wedge that rested against the larger post.

Feature 18 was a hangi pit filled with black greasy sand and protruding out of it from the bottom was a very large oval piece of whitish pumice.

Post hole 19 was 126 cm below datum at its base and 14 cm in diameter. Piled against the edge of the hole on the west side and showing in the baulk was a peaked yellow/white mound of sand which formed a lens within layer 4. It appears to be a pile of wind-blown sand that had accumulated against the post and become part of the layer.

Post hole 20 was close to but slightly north-west of hole 19. It was 14 cm across and about 114 cm below datum. Just below the surface was a stone that may have been placed to shore up the post.

Post hole 21, half of which remained in the baulk, was a shallow stake hole with the tip 94 cm below datum. It was 10 cm in diameter and was filled with grey sand.

Post hole 22, also a stake hole, had the point of the stake still in position. It had its origin in layer 4, but its pointed end was inserted in the ground and the wooden end remained *in situ* close to the position of the stone reel and file/saw in layer 5 (Fig. 19). It entered the ground at a slight angle, west to east.

Feature 23 was a hangi pit containing hangi stones. It was 60 cm across and the stones were intermixed with greasy black sand and charcoal, as were hangi 24 and 25. On the north-west side was an area free of stones. This stone-clear area was partly enclosed on the north side by an edging of stones.

Feature 24 was a very large hangi half of which remained in the north baulk. It measured 150 cm across and contained some very large stones. There were numerous other stones in this area of the square and the separation of hangi 23 and 24 was not as evident when excavation was being carried on.

Feature 25 was another very large hangi which occupied the south-west corner of square M 12. It reached about 1 m along the west and south baulk line. The stones were in a single layer rather than heaped, and rested on thick greasy material, although layer 4 in this part of the excavation had become less definite, greyer and sandier. No post holes were associated with hangi 23, 24 and 25.

Layer 5

This was a distinct cultural layer of clean, crisp coarse yellow sand of similar texture to the present beach sand. The layer contained the largest amount of cultural material and covered the whole site. No hangi were found, nor any evidence of fire pits. Numerous pieces of water-worn grey rubble pumice (later identified as Loisels pumice) were mixed with the sand, and, in several areas, the pumice formed concentrated deposits. Towards the west of the site, especially in the vicinity of baulks L 11 and M 11, pumice rubble formed almost the whole layer with a light mixture of sand and occasional shell and bone. It was amongst this rubbly pumice and sand that the stone reel (Figs. 17, 19), large sandstone file/saw (Figs. 19, 24) and bone lure shank were found.

The full significance of this grey pumice rubble (Loisels pumice) was not realised at the time of the excavation, although note was made of its presence and quantity in various parts of the site (see below, p. 69). It was found in smaller amounts in layer 4 but very little in layer 3b.

Midden and cultural material was scattered throughout layer 5 but one feature of the shell content was a number of concentrations of *Amphibola crenata* (mud snail) shells. There were two of these in square M 11 and a few more dispersed concentrations which had once been heaps. Less obvious and smaller in the number of shells, but possibly just as significant, were some aggregations of *Lunella smaragda* (cats-eye shells). As no fire pits were found in the layer these shellfish must have been eaten away from their cooking area. It is difficult to extract the uncooked animal from coil univalves such as *Amphibola* and *Lunella* without breaking the shells and most of these shells were whole. (It would be interesting to know what part the hot springs played, if any, to the importance of the site. Possibly the shellfish were boiled in the hot springs rather than cooked by other methods.)

No structural features were found in layer 5.

Layer 6

This consisted of pockets of yellow-grey sand containing some shell, bones, industrial moa bone and a few artifacts. In square L 10 it was thickest, forming a large pocket that butted up against a small dune formation in the original beach sand. It disappeared near the top of the rise where a post hole was cut from layer 4 down to the sand base (Figs. 5, 6). The layer was a mixture of coarse beach sand, similar in texture and composition to that of layer 5. It differed in its colour from layer 5 in that it was greyer and probably contained more organic material; charcoal or soil. Its colour was very similar to that of layer 3 and 3b but these layers were composed of a much finer textured sand, probably wind blown.

Layer 6 also appeared in small pockets in the north side of square M 11. Only two possible pieces of Loisels pumice were found in the layer, so it is fairly safe to assume that Loisels pumice was not a feature of the layer.

Test Areas

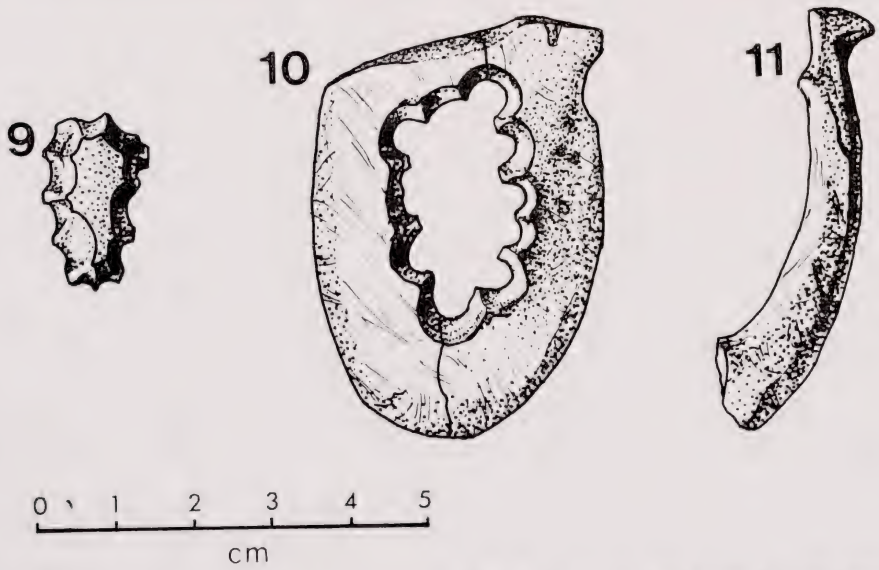
Of the two test areas (Fig. 3), the 50 cm square pit in square M 8 showed no evidence of cultural layers to a depth of 50 cm. The soil consisted of coarse grey sand and shelly grit.

The trial trench in square L 8 had a surface layer of material similar to that of the trial pit. Layer 2 was not present, possibly because, as previously suggested, it was a water-deposited layer and the trench was dug in the area where the ground rises towards the end of the beach to a ridge and the deposit would not settle there. Layer 4 was present, although not as thick as in the main excavation, and layer 5 was also thinning out. Layer 5 still contained some artifactual and midden material but none came from layer 4.

Material Culture

FISHING GEAR

Fishing equipment was represented mainly by fish-hooks and their manufacturing residue. No complete hooks were found. All layers produced evidence of fishing, though in layer 6 it was limited to a bone tab core and a piece of a completed one-piece hook. Trolling was indicated by one bone lure shank in layer 5 and one broken bone lure point in layer 4. Fish bone remains suggest that if nets were used they were probably small ones or hand-held drop nets. Apart from two doubtful pieces of worked pumice which might have been part of net floats, there is nothing to suggest the use of larger nets.



Figs. 9-11. Fish-hook manufacture and sizes. 9. AR 2940. 10. AR 2617. 11. AR 2900.

FISH-HOOKS AND THEIR MANUFACTURE

Bone tabs

Only one unused prepared tab was found and that is in the McCartney collection. The rest represent most degrees of working and completion. All tabs, except the McCartney one, show some centrally drilled areas. There is no evidence that tabs were prepared on the site, although there was a considerable number of small pieces of waste bone. The material from Mt Camel (N6/4) at Houhora, held in the Auckland Museum, seems to indicate that there, some large tabs were made from the wide flat area just below the joint-head of the bone. Some unfinished or broken tabs had been drilled out from this area and then filed smooth around the outside edge. No cut, drilled or broken joint articulating surfaces from moa or any other large animal were found at Hot Water Beach and this suggests that long bones without joints, and tabs, were brought to the site from elsewhere. This material was then split, filed or drilled on the site as required.

The most common remains of fish-hook manufacture are the waste bone pieces drilled from the interior of the tabs, that is the tab cores. An attempt to estimate the original size of the tabs and resulting fish-hooks has been made. Bone tab AR 2617 (Fig. 10) from square M 10, layer 5, has approximately the same proportions as the broken hook AR 2900 (Fig. 11) from the same square. Tab core AR 2940 (Fig. 9) from square L 10, layer 5, although not the original core, fits fairly neatly within the blank area of the tab. It appears that this size of core produced a hook of the approximate proportions of AR 2900. Length measurements were made of all the cores in the site. (Other measurements, width, thickness and number of drill holes were also made but did not appear as relevant as the length.) Tab core AR 2940 measured 2.2 cm in length and appeared to be about a median size for cores in layer 5.

Table 1 gives the number of cores in each layer, the size of the longest, the shortest and the median.

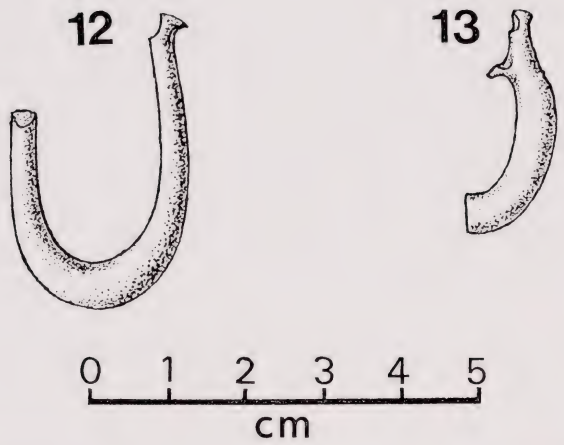
Table 1. Number and length of bone fish-hook cores.

LAYER	Number	Longest cm	Shortest cm	Median cm
3b	6	2.6	1.4	2.5
4	26	3.4	1.1	2.2
5	96	3.3	0.7	2.2
6	1	2.3	2.3	2.3

Any core over 3 cm long would probably produce a large hook for the site and anything under 1.5 cm a small hook, with 2.2 cm being a median. The hook shown in Fig. 11 would be a middle-sized hook for the site.

Layer 5 had 11 cores 1.5 cm long or smaller and 8 cores 3 cm or above. Layer 4 had one 1.5 cm or smaller and four 3 cm or above. Layer 3b had one core 1.5 cm long or smaller and none above 3 cm.

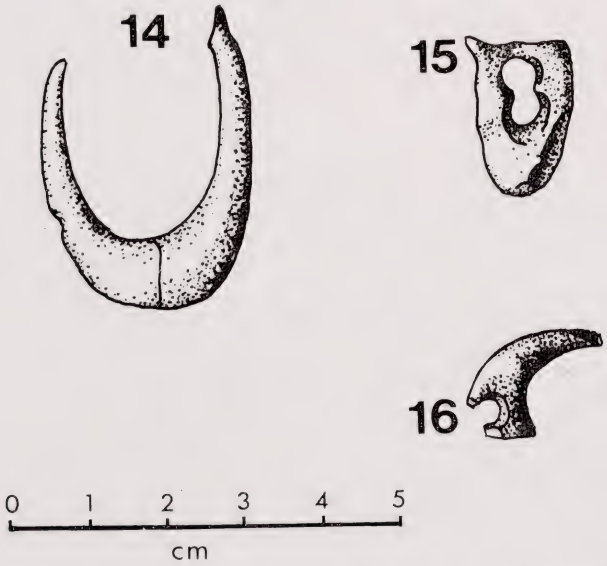
The decrease in cores from layer 5 up in the site probably indicates the increasing scarcity of moa bone. Some layer 3b cores may be intrusions from lower layers (see p. 29, Feature 3).



Figs. 12, 13. 12. Broken one-piece bone hook, Layer 5. 13. Broken shell hook, Layer 3b.

Fish-hooks

Layer 3b had very little in the way of fish-hook material. AR 2902 (Fig. 13) from square L 10, is a small shell hook made from the fresh water mussel (*Hyridella* sp.) (A. W. B. Powell, pers. comm.). It has an internal barb or lashing knob just below the small lashing head. The back or external portion has been ground concave below the lashing knob leaving a roughened area, the edges of which show a number of fine scratches or grooves. This roughened area, as well as being necessary to form the knob, would also help the cord to grip the lashing area. The hook has been broken at the base of the curve.



Figs. 14-16. 14. Broken bone hook, Layer 5. 15. Small fish-hook tab, Layer 3b. 16. Broken lure point, Layer 4.

One small complete thin drilled tab, AR 2917 (Fig. 15) was found in square L 11. This would have made a very small hook if it had been completed. Although it cannot be identitfied as to material it is small enough to have been formed from the tooth of an animal such as a seal or shark.

Both these fishing items in layer 3b appear rather different from the fish-hook material in the other two main cultural layers, and it is postulated that they represented a change in fishing styles or activities from the previous two layers and the need to make use of materials other than moa bone.

Portions of completed hooks were found in layer 3b. Two of these were from the fill of the pit in square L 11, but this fill could have contained intrusive material from layer 4. The other items were a small broken bone tab from square M 11 and a small piece of a completed one-piece bone hook from the same square.

Layer 4 contained five shank legs with heads, from one-piece fish-hooks, but no point ends. The broken tabs, tab cores and part fish-hooks are similar to those of layer 5 but fewer in number.

Layer 5 produced the most evidence for fish-hook manufacture and use. There were a number of broken tabs, partially completed hooks and several small portions of one-piece bone hooks with no heads or points. This layer also contained the shank legs with heads of 15 completed hooks and 4 shank legs with points. There were also two almost complete hooks.

One of these almost complete hooks, AR 2905/2906 (Fig. 14) is a one-piece bone hook from square M 10, broken across the base with the head snapped at an angle across the shoulder. The tip of the point is only slightly incurved. About 2 cm below the tip there is a shallow bait notch just where the outer edge starts to curve round to the base of the hook.

AR 2888 (Fig. 12) is a slender hook with a small head tilted back at an angle from the long axis of the shank. The tip of the point has been broken off. It is rather similar to AR 2905/2906 but slightly thinner at the base and it has no bait notch.

One other part hook, AR 2911, consists of a thick laterally flattened curved base which narrows, by a distinct shoulder, to a thin oval-sectioned leg (probably the shank leg) broken just below the head. The other leg continues up in the same thickness as the base but has been broken across the grain about one-third of the way up. Just before the break is a bait notch. This hook seems to be an attempt to overcome the weakness bone hooks have of breaking across the grain where the point of greatest stress comes, between the hook head and the point.

Although layer 6 appeared only in small pockets below layer 5, evidence for fishing was indicated by a tab core and part of a completed one-piece hook.

Lures

Layer 3b contained no evidence of trolling.

AR 2892 from layer 4 is a bone lure point with a single lashing hole (broken) and the point tip broken (Fig. 16). It has been blackened by fire. It was found in square L 11 in the part of layer 4 that covered the layer 5 Loisels rubble containing the lure shank.

One piece of point-shaped bone, AR 3369, was also found in layer 4. It has no suggestion of a lashing hole and no tip but it is thick at one end and tapers abruptly, showing a curve which appears abnormal for a one-piece fish-hook. Compared with AR 2892 it seems to conform more closely to a lure point than part of a one-piece hook but it shows no diagnostic features. An oval shaped piece of shell, AR 3314 (*Dosinia* sp.), was also found in this layer, filed flat along one side and along part of the other. It might have been part of an unfinished shell lure shank but this is doubtful.

A moa bone lure shank, AR 2881, together with several pieces of moa bone, some of which showed signs of working, were found in layer 5 in a pocket of Loisels pumice in square L 11. The bone shank measures 9.8 cm in length and 0.8 cm in thickness. At its widest part it is 1.9 cm across. It has a rounded head with a dorso-ventral hole for a line attachment and is rectangular in cross section. It has a step and shouldered tail lashing. Similar lures have been found at Pig Bay, Motutapu, N38/21 (Golson 1959b, p. 46 and Fig. 7, p. 42). I have a photograph of a similar one found at Sarah's Gully in 1959/60, possibly a surface find.

Discussion

The fishing equipment recorded from the site consists of two types in layers 4, 5 and 6. The most common is the oval one-piece bone hook defined by Crosby as the Opito, type 1 (Crosby 1966, p. 187). This was being made at the site from bone tabs that were probably prepared elsewhere. The other is the lure or trolling hook, Crosby's early dorso-ventral Tairua type lure shank, found in layer 5 (ibid., p. 115). This she couples with the deep curved bone lure point (ibid., p. 148) found in layer 4. She goes on to say that the chief area in the North Island for the distribution of the Opito 1 hooks coincides with the distribution of the Tairua type and the Whitipirorua sub-type of dorso-ventral trolling hooks. This appears to be so for Hot Water Beach. Thus fishing material from layers 4, 5 and 6 belongs to part of a homogeneous and well established tradition in the Coromandel area when seen within the wider context of other sites in the North Island.

If there is any indication of change, it comes in layer 3b where the Opito 1 hooks are hardly if at all represented. (Most of the Opito type 1 pieces came from the fill of the 3b pit and this fill could have in part come from the disturbance of lower layers for fill material and not be part of the layer 3b occupation).

Crosby (1966, p. 210) states that, "For the period when the *Opito* 1 type cease to be the common form of small hook in Coromandel fewer fish-hooks were recorded but those that were noted exhibit influence from Northland and also from the Bay of Plenty and the East Coast (*Hahei* and Portland types)."

The first part of that statement would apply to layer 3b although what outside influences, if any, the shell hook and the small tab outline show needs further investigation.

ORNAMENTS

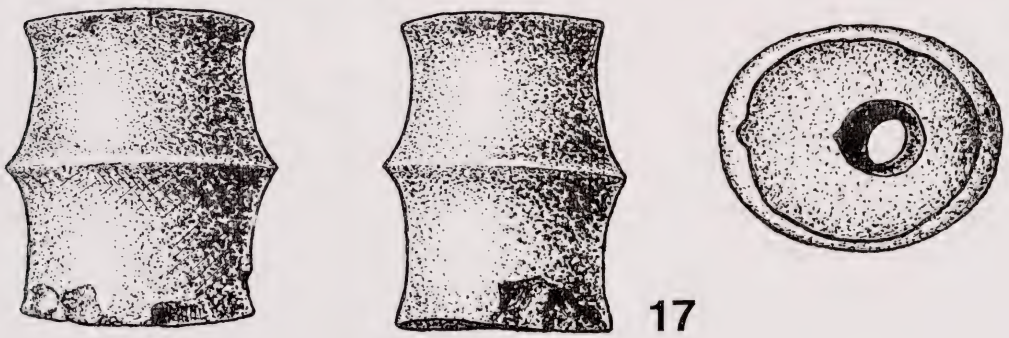
A number of artifacts, presumed to be ornaments, were found in the site. Similar ornaments were found in the Opito midden, N40/3, layer 4 (see below, p. 70).

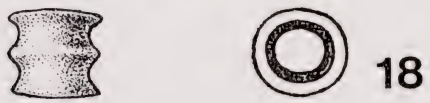
It is common practice in New Zealand to use the term "necklace" units to describe items of presumed personal adornment which have been drilled to suggest stringing. This is a reasonable assumption but it is interesting to note that Banks states (Beaglehole 1962, p. 17):

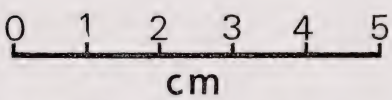
> Besides these they hung to them by strings many very different thing(s), often chissels or bodkins made of a kind of green talk which they value much, the nails and teeth also of their deceased relations, dogs teeth, and in short every thing they could get which was either valuable or ornamental. Besides these the Women wore sometimes Bracelets and anclets made of the Bones of Birds, shells, &c. . . .

Banks also describes other types of ornamentation including various items made of wood, feathers, etc, which would be unlikely to survive in an archaeological context.

Evidence for the manufacture of ornaments on the site is suggested by a partly completed bone or ivory reel and an incomplete bird bone tube unit. Ornament preparation of a time consuming nature appeared part of the economic activities of the groups that occupied the site, especially the layer 5 occupants. The items were in sufficient quantities to suggest that they were a significant enough part of their social organisation to warrant the time spent on them.







Figs. 17, 18. 17. Stone reel from Layer 5. 18. Dentalium reel unit, Layer 5.

Stone reel

A stone reel, AR 2879 (Figs. 17, 19) was found in square L 11, layer 5, in the L 11/M 11 baulk. It measures 4.46 cm in length, 3.6 cm in width and weighs 73.3 g. It is made of serpentine, but the source has not been established (R. N. Brothers, pers. comm., E. J. Searle, pers. comm.). A personal inspection of the reels held in the Canterbury Museum (without the Hot Water Beach reel) produced only one which in appearance had the same type of stone and that was one from a site near the mouth of the Rakaia River, South Island (Trotter 1972, pp. 137-138). Trotter suggests Carbon 14 dates of 585 ± 64 and 518 ± 80 B.P. for the site (ibid., p. 135). The Rakaia reel is not of the same shape and is smaller than the Hot Water Beach one.

Fig. 19. Stone reel, abrader file and wooden peg *in situ* Baulk L 11, Layer 5.

The Hot Water Beach reel is rather oval in cross section and has three raised ridges, one in the centre and one at either end. The central ridge is about 0.2 cm wider than the end ones. Considerable damage by mishandling, age or deliberate modification has caused numerous small flakes to be knocked from the raised end ridges. These chips occurred after the completion and polishing of the reel.

The reel was found during the removal of the final baulks and was in the coarse yellow layer 5 sand. This was part of an area where there was a considerable amount of Loisels pumice which extended into square L 11 as a thick pocket and in which several pieces of industrial moa bone and the bone lure shank were found. Closely associated with the reel was a large flat sandstone abrader/saw AR 2880 (Figs. 24, 19), the blade of which was stuck down into the pumice rubble which formed part of layer 5, north of and at an angle almost covering the reel. Figure 19 also shows the end of a wooden stake inserted in the sand but this had its origin in layer 4.

Bone or ivory reels

Two of these are held in the McCartney collection and come from layer 5. One is centrally perforated and has three external ridges. It is 1.2 cm long and 1.1 cm wide. At one end the drilled hole is angled, almost piercing the side of the reel. The hole at the other end is correctly placed. The central ridge has an irregular curve to it. It is possible that this was deliberately offset to counteract the weakness in the central drill hole but the other reel shows the same irregularity. This second reel is in the process of manufacture. It is larger than the first, being 1.6 cm long and 1.4 cm wide and slightly oval in shape. The end ridges are more pronounced and the two end surfaces are flattened and show filing striations in the bone surfaces. There is no sign of drilling from either end. One end has a large chip off the side and the area seems darkened as if charred. It is possible that this chip led to its abandonment during manufacture.

Dentalium shell units

Three units of the large fossil *Dentalium nanum* shells were found in layer 5. Two are in the McCartney collection and the other, AR 2512, is held in the Auckland Museum collection (Fig. 18). AR 2512 is 1.1 cm long and 1.2 cm wide and has, like the other reels, three raised ridges. The other two are similar but one is shorter and wider, being 0.9 cm long and 1.2 cm wide. The other is 1.1 x 1.1 cm in size. It is possible that these three units may have come from the same shell, as they appear to grade slightly down in width.

Dentalium units of the small size were also found in the excavation. AR 3196 was a small shell tube filed flat at both ends. It measured 0.6 cm in length and 0.3 cm in width. It was found in square M 10, layer 5, as was AR 2915. This was a longer piece, 1.6 cm and 0.2 cm across. It had also been filed flat at either end.

Bird bone tube units

Four of these were found in layer 5. AR 3517 came from L 11 and is 1.1 cm long by 0.4 cm across. AR 3196, square M 10, is 1.2 cm by 0.4 cm wide, and AR 2903, from L 10, is 1.0 cm long and 0.4 cm wide. It is a darker colour than the others.

AR 2909 was found in square M 11, in the M 10/M 11 baulk. It is 1.3 cm long and 0.4 cm across. This unit was in the process of manufacture and showed several shallow grooves across the bone before the final deeper circular groove. It had been been snapped, leaving the broken edge.

Comb fragment (?)

A thin flat piece of bone, AR 3015, 1.5 cm wide, 3.0 cm long and between 0.2 and 0.3 cm thick was found in square L 10, layer 5, in the L 10/M 10 baulk. It has been flattened on both sides to a very smooth surface. One edge has been filed straight and then turns a corner to rise to a rounded knob which drops on the other side to a flat edge where the bone is snapped along the grain. The fragment can be fitted into the type B style as defined by Shawcross (1964, Fig. 5, p. 389). However, because of its fragmentary nature, lack of teeth and other diagnostic features, other than the raised knob, the nature of this artifact remains in doubt.

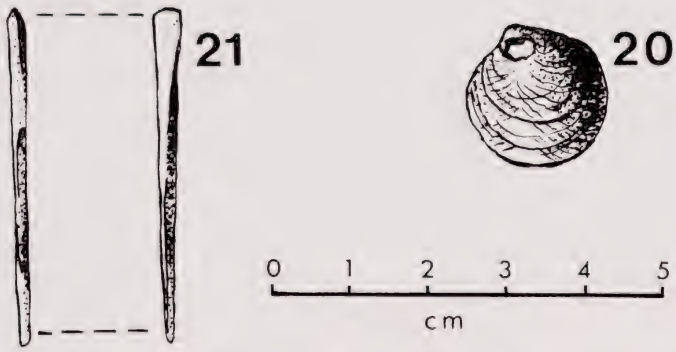
Tattooing chisel (?)

A possible tattooing chisel, AR 2894, was found in square M 11, layer 3b. This consists of a flat sliver of bone 0.7 cm wide across the squared off top and widening out to 0.9 cm just above the break where the teeth points may have been, but no indication of these teeth shows on the bone above the break. It is 2.6 cm long. There is a circular hole 0.3 cm in diameter situated centrally and 0.5 cm below the square top. There is a longitudinal break dividing the piece into two parts through the hole, possibly of later origin than the break above the "teeth". In size, shape and general appearance it conforms to several of the tattooing chisels held at the Auckland Museum, except for the missing teeth.

Artificially pierced shells

These have no context in the site as they were found amongst the disturbed material removed from M 10 at the beginning of the excavation to establish the boundaries of the fossicked area. This material was sieved and bagged for later checking. A considerable amount of artifactual material came from these bags and amongst it, in one bag, were five shells of *Divaricella huttoniana*. Each shell had a hole at the base of the central hinge (Fig. 20). These perforations were examined and it was established that they are too irregular to have been caused by a shell borer and could be presumed to be artificially made (W. Cernohorsky, pers. comm.).

No other shells of this species were found in the site and as it is not a known food species it was probably picked up from beach debris. It can be found on beaches in the area. Morton and Millar (1968, p. 464) state that it is an uncommon bivalve washed up on ocean beaches, distinguished by its snow-white shell, and chevron-patterned sculpture. The shells vary in size from 1.7 cm to 2.4 cm in length. They are fairly chipped round the edges and very fragile. One shell has a reddish deposit along one side and over the interior which, under the microscope, appears as a very fine-grained deposit compared with the sand grains also adhering to it. The material does not stain the shell surface and is probably kokowai.



Figs. 20, 21. 20. Artificially pierced shell *Divaricella huttoniana* from disturbed material. 21. Worked and fashioned bone artifact, Layer 5.

Because of the thinning out of the cultural layer 3b in the M 10 area these pierced shells probably were from either layer 4 or layer 5. As layer 4 was black and fairly greasy and the shells have clean sand adhering to them, and as no other ornaments were found in layer 4, it is very likely that these shells were part of the layer 5 deposits.

SHELL ARTIFACTS

Shells showing use were found in layers 3b, 4 and 5 and this use was of two types. One type appeared to be pressure flaking along the edge of the shell as if used for scraping, and the other type produced a flat ground edge (or else a flat ground edge was made deliberately for some unknown function).

Two *Amphidesma australe* (pipi) shells from layer 3b and three pieces of either *Amphidesma australe* or *A. subtriangulatum* shell (tuatua) showed pressured flaked edges.

In layer 4 one piece of elongated oval shell, shaped from a valve of *Dosinia* sp., had one end and side artificially flattened. It may possibly be a scraper, or more doubtfully, an unfinished shell lure. One *Amphidesma australe* shell with pressure flaked edges and two pieces of flat-edged shell were also found.

Three *Amphidesma australe* shells with pressure flaked edges and two pieces with flattened edges were found in layer 5.

BONE ARTIFACTS AND WORKED BONE

Two small pieces of worked bone were found in layer 3b. One had been sharpened to a point by a cut on one side of the bone. It was blackened by fire. The other is a piece of moa bone smoothed on one side. It was found, together with broken fish hook parts, in the fill of the pit in squares L 11/M 11.

The point of a large needle made from a hollow bone, probably bird, was found in layer 4, square L 10. The point is formed by cutting the bone diagonally across the end and then smoothing it. The bone is blackened as if charred, as are several

other items from this square. Two other pieces similar to it but with no ends were also found but could not be matched to the point. Layer 4 contained several other pieces of drilled, filed and worked bone. The crown of a tooth, probably of a sea mammal, split down the middle, was also found. One side has a notch in it and the enamel is chipped, possibly by pressure flaking.

The largest amount of worked bone and bone artifacts was in layer 5.

One complete slender bone needle measuring 7.1 cm in length and about 0.15 cm in width is in the McCartney collection. It is pointed rather than rounded at the apex above the eyelet and has a very small eyelet hole. It is slightly flattened on either side, probably following the structure of the original bone, and is highly polished.

AR 2908 from square M 11 is an unfinished needle which is slightly curved laterally and rectangular in cross-section with an off-centre uncompleted eyelet hole. It measures 6.4 cm long and is 0.3 cm wide. The end has been roughly pointed by cut facets but it has not been polished. The eyelet portion of a large needle, AR 2918, came from square L 10. It is 2.8 cm in length to the break, about 0.8 cm wide and 0.4 cm thick. It is slightly tapered at the eyelet end but rounded above it. The eyelet has been drilled from both sides and is slightly off-centre but this has not weakened it. It is slightly rounded on one surface and flattened on the other. The needle is of a dark brown colour and is highly polished.

Two other artifacts in bone that appear to have been completed are AR 2891 and AR 3246, both from square M 10. AR 2891 (Fig. 21) is a sliver of bone, needle-like in shape but with a flattened portion at one end and a point at the other. The flattened end has a bifacial bevel to it. It is 4.2 cm long, 0.3 cm at the flattened end and tapers to a point at the other. Although the shaft shows cutting facets down it, these have been polished. There is no suggestion of an eyelet hole. Although its purpose is unknown, it could welll have been a useful instrument for removing univalve shellfish from their shell.

The other artifact, AR 3246, is an oval bone flake (rather like a flattened tuatua shell), possibly some kind of a scraper. It has been filed flat along the "back" edge and the end edges have rounded but angular facets. The "front" edge is naturally sharp, as a result of the flaking. One surface is flat following the bone structure and the other is flattish but showed some filing or polishing. It is 3.3 cm in length, 1.6 cm wide and about 0.4 cm thick. A bone awl, held in the McCartney collection, also came from layer 5. This has been made from the joint and shaft of a limb bone of an animal, probably a dog. The shaft is cut diagonally across and the point formed into a short protrusion with a rounded point. It is 6.4 cm long, the width across the top of the joint is 1.8 cm and the width at the cut end of the shaft is 1.0 cm.

Other worked bone was found in the layer but it was all uncompleted. A long shaft of hollow bone has been cut at one end by grooving and breaking, the other end just being snapped. It is 10.5 cm long and about 1.3 cm wide. There are also several pieces of moa bone showing either grooving, cutting, drilling or smoothing.

AR 3417 from square M 11 is the distal end of the right humerus of *Nestor meridionalis* (kaka). This has a groove cut across the base of the joint and then another

groove which allowed the breaking of the shaft at this point. This piece of worked bone is the one mentioned on p. 62.

In layer 6, square M 11, a moa bone splinter, 6.1 cm in length and 1.7 cm wide, was found. It was pointed at both ends by breaking and just below the widest part is a drill hole half of which has broken.

ADZES

Seven adzes and roughouts were found in the site (one small roughout was collected on a later visit as a surface find). The adzes and roughouts in the site appear to have been made by flaking and then polishing (if a completed adze). Hammer-dressing only occurred occasionally. Adzes were made from cores rather than flakes (see Nicholls 1964, p. 32).

Polishing appears to have been kept to the minimum required for efficiency. There is nothing in the adze assemblage to suggest anything other than the Archaic style although the carbon dates for layer 4 might appear rather late. Certainly the one roughout from layer 3b appears to reflect continuity in adze manufacture although other evidence, such as fish-hooks and decrease in moa bone, might indicate some technological change from layers 4 and 5 to layer 3b.

AR 2921 is a roughout from layer 3b. Its length is 5.6 cm, width at the blade 3.8 cm and it is 2.0 cm thick. There is some indication that it could have been slightly sub-triangular if it had been completed. It is made from a medium-grained grey-black stone which is probably basalt.

Four specimens came from layer 4. AR 2564 is a triangular-shaped roughout similar to a Duff Type 4 B (Duff 1956, Fig. 43) at the blade end but tapering rather abruptly behind the apex and possibly broken at the butt end. Its length is 8.2 cm and it measures 5.6 cm at the blade edge, tapering to 2.6 cm at the butt end. It shows no sign of polishing or hammer dressing. There is a small patch of orange-brown weathered cortex on one side near the butt end. It was found during the preliminary test dig.

AR 3284 is the rectangular butt end of what appears to be a small adze or the corner of a butt of a larger adze. It is a greeny-black colour and is a fine-grained stone. One side shows a small amount of grinding and there has been some possible polishing of the butt. The front surface shows a flake scar from the butt down and one edge has several small flakes removed possibly by pressure flaking. It may have been broken and the piece used as a working flake. It measures 3 cm down, is 2.8 cm wide at the break and 1.8 cm at the butt and is about 1.2 cm thick.

Two adze roughouts found in the McCartney excavation are assigned to layer 4. They were found at the top of a greasy yellow sand layer above layer 5 and below the black greasy layer 4. By their position in the site, they were associated with the yellow sandy clay (feature 15, Fig. 8). This clay layer thickened nearer the beach, being between 5-9 cm thick in the preliminary test excavation and would have continued on into the McCartney excavation. The larger of the two specimens is 8.2 cm in length, 3.4 cm wide and 1.9 cm thick. It is similar to the Duff Type 3 B

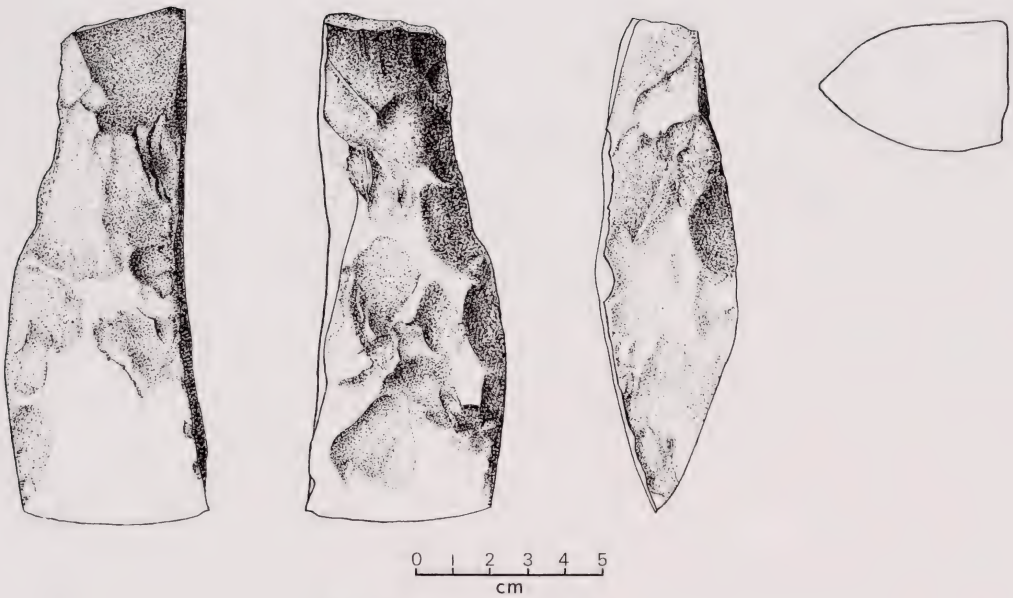


Fig. 22. Side hafted adze, Layer 5.

(triangular, apex down) (Duff 1956, Fig. 38) but shorter and thicker. It is made from a grey-black fine-grained stone and is polished on the bevel and partially polished on the front surface. There are two large chips knocked off the bevel edge. It shows no hammer dressing.

The smaller roughout is almost triangular, both from bevel to butt and from side to side. The blade has large flakes taken from both sides and one side of the adze is flaked flat while the other narrows to a more rounded ridge. It is more the shape of an incipient side hafted adze, but had probably been broken in half during manufacture. It is very much a "roughout". Its length is 6.6 cm, width at blade 4.1 cm and thickness at the broken end 2.8 cm. It is made from a greyish-black medium-grained stone, and appears to be slightly sand blasted.

Two complete adzes were found in layer 5. AR 2521 was found by Mrs McCartney during her excavation in the coarse yellow sand of layer 5 together with the bone reels and other artifacts. It is a "side hafted" adze of the Duff Type 5 (Duff 1956, Fig. 48), 13 cm long with a blade width of 4.9 cm (Fig. 22). It is 4.7 cm at its thickest part across the broad flat hafting surface. The upper part of the butt, where it narrows, has been hammer dressed, no doubt to remove the sharp flaking edges to prevent wear on the lashing. The adze has been formed by flaking and then the two sides of the blade polished. The rest shows irregular grinding and polishing facets over the ridges of the flaking scars. On one side near the butt is a small area of creamy-brown weathered cortex.

AR 2920 (Fig. 23) is a small bluey-black adze from square M 11, layer 5. It is roughly quadrangular in cross-section, 5 cm long and the width of the blade is 2.9 cm.

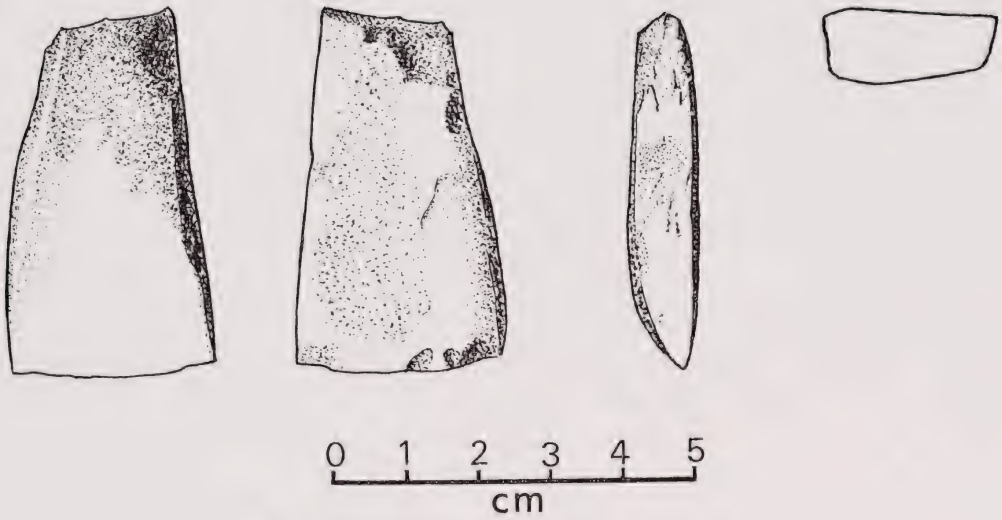


Fig. 23. Small polished adze from Layer 5.

The adze narrows down to a butt end which is about one-third of the width of the blade and ends abruptly, showing a sharp single flake scar which could have been accidental or deliberate.

The blade has a rather curved bevel but two small side facets emphasise the actual blade angle across the curve. The adze has been polished all over except for the poll and where flake scars have been too deep to erase. A series of small chips about 2-3 mm in size has been broken off the front of the blade. Although the adze is a small one it is not clear if it is a flake or a core adze.

One small partially polished adze, AR 4109, was collected as a surface find later. This was a core that has been flaked to shape and then polished at the bevel edge, but three chips have been knocked from the edge after polishing. The front surface also has been slightly polished up to where the butt has been modified by having a large flake struck from one side, thus forming an irregular shoulder, probably for hafting. The butt end is much narrower than the blade. It measures 6.2 cm in length, the blade is 3.3 cm wide and the thickness at the butt end is 1.6 cm. From the blade it tapers more abruptly towards the butt on one side than the other.

ABRADERS

The central portion of a lenticular file with part of one side broken away was found in layer 3b.

Layer 4 contained two tips from lenticular files and one shouldered lenticular file with the tip broken. A corner of a small broken hoanga (grindstone) with one surface worn was also found.

AR 2880 (Fig. 24) was found in association with the stone reel in layer 5, square L-11. It is 21.5 cm long, 7.5 cm wide at the widest point and about 1.4 cm thick. It has been made from a flat piece of coarse-grained stone, split along a cleavage plane.

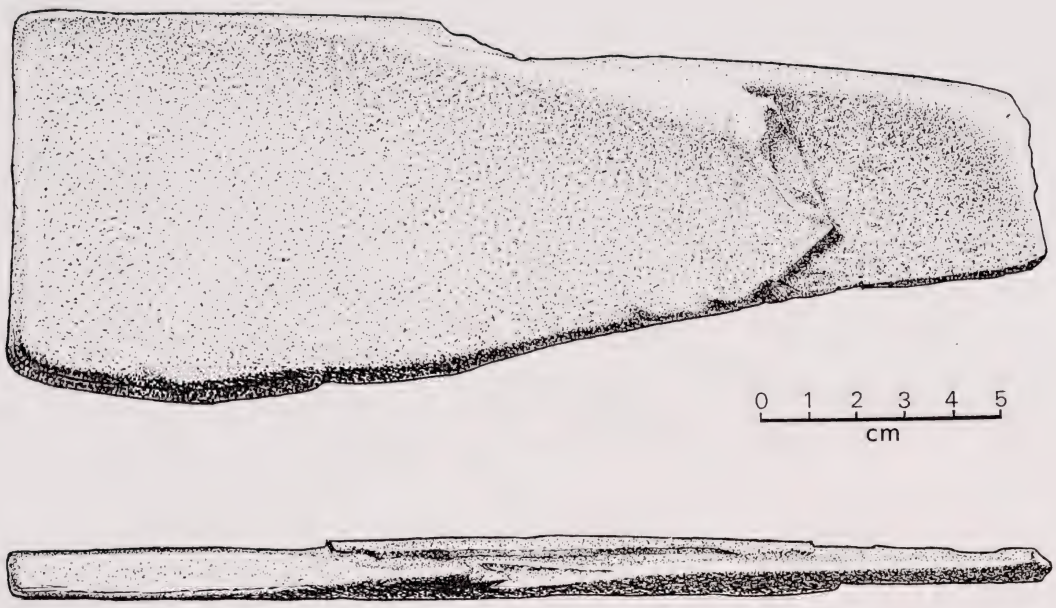


Fig. 24. Abrader saw from Layer 5.

It is narrower at one end than the other. One side has been hammer dressed along the edge, either to modify an uneven area or to provide a rough gripping surface. The working edge is worn smooth on either side for three-quarters of its length to form a long narrow smooth sawing edge that extends up the blade to almost 3 cm in places on either side of the edge. The apex of the edge is slightly flattened. The working surface extends round the narrow end of the blade. Because of its association with the stone reel and the fact that bone reels were being manufactured in the layer, it may well have been one of the instruments used in their manufacture.

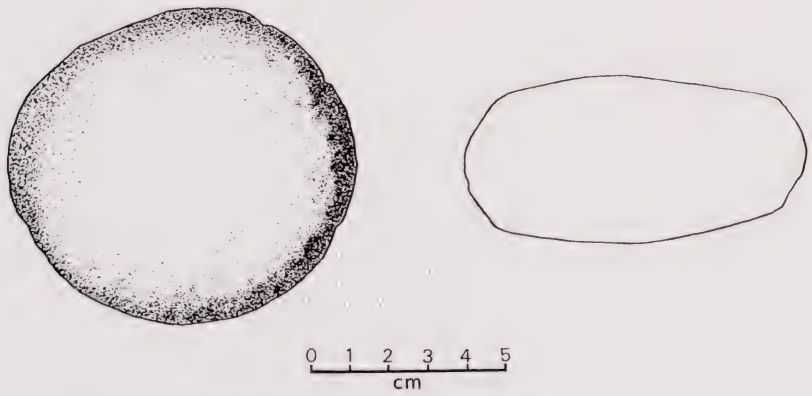


Fig. 25. Round abrader from Layer 5.

AR 2895 from square M 12, layer 5, is a circular to ovoid pinkish coarse-grained stone, flattened top and bottom (Fig. 25). It is 9 cm in diameter at its widest part and 7.5 cm across its narrowest and is 4.3 cm thick. The sides are roughened or bruised, with the bruising more obvious at the ends of the long side, suggesting that a hammer stone may have been one of its uses, but the soft nature of the material would preclude its use on any hard material. The upper and lower flat surfaces are considerably smoother than the rest of the stone and in places they are almost polished. It fits easily into the hand and would be very suitable as an abrader to smooth over and flatten moa bone fish-hook tabs amongst other things.

Four tips of sandstone files, lenticular but with flattened sides, were found in layer 5. There was also the broken end of a rather pointed file, one larger file complete except for the tip being broken off and several "interior" pieces. Three lumps of roundish coarse sandstone were interpreted as possible roughouts for file preparation (see Law 1970, pp. 84-85). One squared corner of sandstone or similar material rough on one side and having part of a smooth saucer-shaped depression indicating use as a hoanga, was also found in layer 5.

WORKED PUMICE

Although there was a lot of pumice throughout the site, very little appeared to have been used.

Layer 3b had only one possible flattened piece of pumice that might have been an abrader, but it is doubtful.

Two pieces from layer 4 showed use. One is an oval piece about 8 x 4 cm with a well defined groove along a narrow side as if it had been rubbed up and down a long thin object. On one of its flattish surfaces is a small oval V-shaped hole, possibly made by smoothing off a point. AR 3343b is a square corner of grey glassy abrasive pumice about 5.7 cm long which has been shaped and broken diagonally across the corner. The sides have been angled in to make it narrower at the "top" than the "base". Centrally placed along the diagonal break is the remaining half of a hole drilled from either side. On the "base" surface are several pointed indentations. The sharp abrasive nature of the material does not suggest its use as a net float.

Two pieces of flattened pumice, probably of natural origin, were found in layer 5.

STONE POINTS AND DRILLS

There is a wide variety of points ranging from very small (1.4 cm) to large (8.9 cm). They have been divided, according to material, into siliceous and basalt, and according to cross-section into sub-categories of triangular and rectangular. The triangular points in most cases require considerably more flaking and fashioning than the rectangular ones. The triangular points were more common (Table 2) and possibly economically more important or more efficient, but the rectangular ones may have been used for a special purpose.

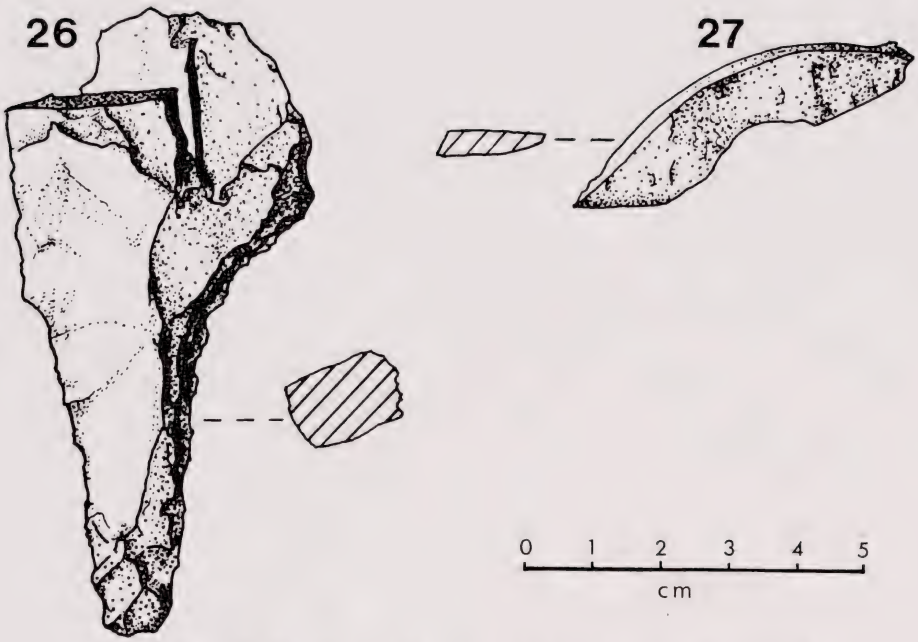
Table 2. Number, distribution and size of stone points, N44/69.

	Layer 3b	Layer 4	Layer 5
Siliceous			
Cross section			
Triangular	7	13	27
Rectangular	2	5	11
Basalt			
Cross section			
Triangular	—	2	—
Rectangular	—	2	2
Total:	9	22	40
Siliceous			
Broken, used			
Tips	3	5	18
Bases	1	2	12
Unfinished	3	4	21
Total:	7	11	51
Total All points:	16	33	91
Sizes (length)	(cm)	(cm)	(cm)
Maximum	5.2	5.3	5.0
Minimum	3.0	1.8	1.4
Median	3.3 — 3.5	3.2	3.3

The methods of manufacture of siliceous points are similar to those described by Nicholls (1964, p. 30) and Law (1972, pp. 92-93). Broken drill points were very common and all layers except layer 6 produced a number of unfinished or discarded points. The 21 unfinished points from layer 5 suggests that drilling activity and the need for a good supply were important at that time.

Within the siliceous category the quartz points generally were smaller than the other siliceous ones, e.g. jasper, carnelian and fossilised wood. This may have been the result of the nature of the material and its working qualities rather than choice. The smallest point was from layer 5. It was of quartz, 1.4 cm long with a very fine point which would have been more appropriate for drilling eyelet holes in needles than for fish-hook manufacture.

Basalt points were also present in the site. Two from layer 4 were similar in form to the triangular siliceous points. The larger basalt points, so called "hand-held" types, are not included in Table 2. One, AR 3063, from layer 3b, may have been used as an abrader rather than a drill point or may have served a dual purpose. It is a long triangular basalt flake with a tapering shaft and a round end. The back side is



Figs. 26, 27. 26. Basalt point, Layer 4. 27. Basalt flake knife, Layer 5.

flat with two sharp edge angles but the front is rather smooth and rounded, showing signs of rubbing or wear. It measures 7 cm in length.

One "hand-held" basalt point was found in layer 4 (Fig. 26) and two in layer 5.

BASALT FLAKE "KNIFE"

A crescent-shaped basalt flake, AR 2949, was found in layer 5, square L 10 (Fig. 27). It is 5.2 cm long and 1.2 cm at its widest part. The rounded "back" is smooth, flat and partially polished and both sides have had the rough areas smoothed by polishing. One end has been flattened by polishing into a blade that ends in a point, giving it a rather scalpel-like appearance. Although one or two of the basalt flakes have secondary flakes removed from them, this is the only shaped basalt tool apart from the adzes and basalt drill points.

STONE FLAKES

A large number of stone flakes were recovered in all the main cultural layers in the site. These were separated into obsidian, basalt and siliceous material for analysis. They were then divided into two groupings, those with definite evidence of use wear (used) and those without such evidence (waste?).

Flake material such as that found at Hot Water Beach seems to form an essential part of the basic technology in New Zealand, either as waste that occurs from the making of core tools, such as adzes, or as flake tools such as knives, points and

scrapers. These tools reflect a wide range of activities and because of this considerable attention has been given to the flake material. Work is still progressing on the analysis. However, some preliminary patterns are already in evidence.

Obsidian

The obsidian was divided into two categories by observation, green being classed as very probably from the Mayor Island source and the rest from "other sources". These two groupings were then sub-divided into used and waste(?). Analysis was done on these major groupings using figures for both the number of pieces and weight.

As the excavated volume of the layers was not equal, a technique for assessing the volume of each layer was adopted. The layer thickness at 50 cm intervals for each baulk wall was taken from the plan drawings. These were then averaged and, using the excavated area of each square, a cubic measure or volume was estimated. Estimates for layers 1, 2 and 3a, where the sterile nature of the soil indicated that they were not cultural deposits and the erratic cultural layer 6, are not considered. Layer 3b averaged 17 cm in depth over the whole site, layer 4, 14 cm, and layer 5, 15.4 cm. The total area excavated was 26.5 m. The average cubic content of the cultural layers was as follows:

Layer 3b = 4.505 m^3, 36.6% of volume
Layer 4 = 3.710 m^3, 30.2% of volume
Layer 5 = 4.081 m^3, 33.2% of volume.

The significance of differences for weight or number of pieces in samples was estimated by calculating the appropriate chi-square values (Snedecor and Cochran 1967, pp. 215-218, 228-236). In general the results are reported only as probably significant, significant and very significant, indicating conventional 5%, 1% and .01% levels of probability respectively.

The raw scores, uncorrected for volume (Tables 3, 4) were calculated first and the layer patterns established. Then the figures were recalculated having been corrected for volume. Patterns and levels of significance were then compared. It was found that correcting for volume of layers sometimes changed the patterns of distribution and the significance of the results.

Table 3. Preliminary analysis of obsidian in layers, by number, N44/69

	LAYER	Mayor Island	Other sources	Total
Waste (?) pieces				
	3b	56	90	146
	4	92	183	275
	5	165	321	486
	6	—	—	—
		313	549	907
Used pieces				
	3b	38	47	85
	4	37	35	72
	5	66	52	118
	6	—	1*	1*
		141	135*	276*

* For the purposes of analysis only layers 3b, 4 and 5 were processed, so that layer 6 material was not included in the totals.

Table 4. Preliminary analysis of obsidian in layers, by weight, N44/69.

	LAYER	Mayor Island	Other sources	Total
		g	g	g
Waste (?) pieces				
	3b	144.7	232.2	376.9
	4	190.3	723.6	913.9
	5	290.5	1359.7	1650.2
	6	—	—	—
		625.5	2315.5	2941.0
Used pieces				
	3b	391.1	446.9	838.0
	4	240.1	363.7	603.8
	5	730.9	649.0	1379.9
	6	—	21.7*	21.7*
		1362.1	1481.3*	2843.4*

* For the purposes of analysis only layers 3b, 4 and 5 were processed, so that layer 6 material was not included in the totals.

It was concluded that inter-layer statistical comparisons not corrected for volume can at times give misleading results. For example, a chi-square value calculated from uncorrected waste Mayor Island obsidian by weight showed that there was a probable significant difference between layers in which layer 3b had more obsidian by weight than expected, layer 4, slightly less than expected and layer 5 less than expected. When corrected for volume there was a very significant difference between layers and the distribution pattern altered. Layer 3b changed to less than expected, but layers 4 and 5 to more than expected. The distribution pattern for the layer totals by weight also changed in a similar fashion.

The following discussion relates mainly to the obsidian results which have been corrected for volume except where specified.

There is a very significant difference between the total number of waste obsidian pieces in the layers. The contribution to the difference comes from layers 3b and 5, with layer 4 exhibiting results very much as expected. The distribution pattern shows layer 3b has fewer pieces than expected and layer 5 more than expected.

When Mayor Island is compared with "other sources", the very significant difference between layers remains, as does the pattern of distribution, with layer 3b less, layer 4 as expected, and layer 5 more. If the source totals, corrected and uncorrected for volume, are compared, it is the category of "other sources" that shows greater degree of change.

The significant excess of waste obsidian in the "other sources" category could well be accounted for by the fact that much of it had an irregular cortex or crust which required removal before the flaking quality obsidian could be obtained. Removal of this cortex occurred at the site (out of a total of 728 "other source" pieces, 279 showed some cortex). Mayor Island obsidian, being mainly mined, showed an insignificant portion of such material.

Used pieces of obsidian by number showed only a probably significant difference between layers but the overall distribution between layers does change. This is especially evident in layer 4 where there is less than expected of the used pieces, the loss being evenly distributed between Mayor Island and "other sources".

There is a significant difference between layers in the pieces of used Mayor Island obsidian by number but no significant difference shows in those from "other sources". It is the Mayor Island layer 5 material that provides most of the difference, something not true for obsidian from the "other sources" in that layer.

It is interesting to note that there were 449 "other sources" pieces (used and waste) without cortex and, out of that number, only 69 pieces showed use wear. Yet of the 428 Mayor Island pieces without cortex there were 125 used pieces, almost double the number.

Generally speaking, layer 3b possesses fewer Mayor Island pieces than expected, but the differences between the observed and expected in the "other sources" material is less, indicating an increasing emphasis on the use of obsidian from "other sources" at the expense of the Mayor Island material. The pattern of pieces of obsidian by number shows there was very significantly more obsidian in total in layer 5 than in the other two layers. It also shows that more Mayor Island material was used in layer 5, whereas the layer 4 results were more or less as expected and the layer 3b results indicated an increasing preference (?) for using material from "other sources". Thus there appeared to be a cultural or mechanical preference for using Mayor Island obsidian throughout the sequence although it is evident in layer 3b that a change to "other sources" was occurring.

The results for waste obsidian by weight, when corrected for volume, follow the same pattern as those by number of waste pieces. Layer 3b has less than expected, layer 4 is as expected and layer 5 has more than expected.

There was also a very significant difference between layers when analysed using the figures for total weight. When separated, the Mayor Island material also exhibited a very significant difference between layers, while "other source" material provided a significant level of difference. While the contrast by weight between layer 3b and layer 5 remains the same as that for the number of pieces, the overall pattern changes, with layer 3b having less and layers 4 and 5 both having more waste by weight than expected. The layer 4 change to more than expected, evident throughout the waste material, though not statistically significant, does seem to indicate the beginning of a trend that is evident in the significant difference between layers 3b and 5. As might be expected from the previous observations, it is the material from the "other sources" which accounts for most of the difference.

The totals for used obsidian by weight exhibit a very significant difference between layers, whereas the used pieces, analysed by number, indicated only a probably significant difference. Again the distribution pattern is one of layer 3b less and layer 5 more than expected. However, in layer 4 the amount by weight is considerably less than expected, with more of the contribution coming from the Mayor Island material

than the material from "other sources". Thus although the number of used pieces in layer 4 is about as expected, this does not hold for their weight. It would appear that the average size of the pieces must therefore be smaller.

Comparisons between the obsidian materials in layers 3b and 5 raises the problem as to whether the activities associated with the layer 5 occupation required more use of obsidian or whether obsidian was more easily available at the earlier end of the site's history. Was the change one in economic activities or was obsidian more difficult to obtain when layer 3b was formed? Was it more difficult, for example, because of warfare, to draw on the Mayor Island source, hence a favouring of the use of "other sources" in the later layer? This hardly seems to be the whole explanation, as the "other sources" category is likely to include a high percentage of readily available obsidian from numerous locations along the Coromandel coast (Ward 1973). Therefore, while the change in preference for source material might have a political explanation, it would seem that the reduction in quantity is more in keeping with the economic changes indicated by midden analysis, i.e. changes in economic activities in which the obsidian was used.

Figures, uncorrected for the volume of the layers, when divided into used and waste groupings show that the used Mayor Island material by weight is, in all cases, greater than the waste material by weight. The material from "other sources", however, shows an excess of waste material by weight over used material in layers 4 and 5. In layer 3b, on the other hand, the pattern reverses, and the weight of waste material is less than that for the used group. Thus the degree of usage of obsidian materials from other sources than Mayor Island (which was always greater than the amount discarded) was less during the formation of layers 4 and 5, but this was reversed during the layer 3b occupation where more "other sources" material by weight was used than discarded. The average size of layer 3b flakes also decreases slightly when compared with the other layers (except the layer 4 used Mayor Island obsidian) while the utilisation of pieces showing cortex material goes up in relation to the other layers. Furthermore, the distribution of obsidian from "other sources" and of cortex pieces throughout the layers suggests that obsidian from other layers was not being reused.

Basalt

The nearest known pre-European basalt quarry is Tahanga (N40/8) at the south end of Opito Beach. This is outside the twenty-five km^2 area being discussed in this report. However, indications are that the grey stone material flake material consists mainly of Tahanga basalt (P. Moore, pers. comm.).

Table 5. Basalt pieces by number, N44/69.

LAYER	Pieces		Cores	Total
	used	waste		
3b	24	190	—	214
4	32	197	2	231
5	41	376	1	418
6	—	4	—	4
	—	—	—	—
	97	767	3	867

There were 864 pieces of basalt, excluding cores, polished and hammer-dressed flakes (Table 5). Of these pieces only 97 showed signs of use wear. However, basalt flakes were used in all layers. There were seven adzes or adze roughouts found but the number of flakes would seem higher than this number of adzes and roughout manufacture would require, unless very large blocks were brought to the site, from which small adzes and roughouts were made. It seems more reasonable to assume that shaped blocks were brought to the site and the adzes finished there and that some of these were taken elsewhere. This is consistent with the size of the waste flakes, which is generally not large, the flakes being more like those from finishing stages of the manufacturing process than those from the initial stages of shaping the block.

Sixty-five flakes showing polishing were found, the majority from layer 5. There were four hammer-dressed flakes, two from layer 5 and two from layer 4. Again this is in keeping with the final stages of adze manufacture, or in the former case, the re-working of already completed adzes.

Siliceous material

The siliceous material, excluding drill points, was separated into two categories, quartz and other stone (jaspers, carnelian and fossilised wood, etc) and these in turn were separated into used and waste pieces.

There were 276 waste quartz pieces having a total weight of 1230 g (rounded figures) and 347 waste pieces in the other materials category, having a weight of 1759 g. Of the used pieces, 105 were quartz (922 g) while there were 79 pieces in the other materials category (847 g).

Layer 3b had the least number of pieces and the least weight of material, layer 4 had more and layer 5 contained considerably more by number and weight than the other two layers. In fact it had almost twice as much siliceous material as the combined totals of layers 3b and 4. This parallels the pattern observed for the drill points noted above.

In addition there were 606 chips (pieces under 1 cm in size) of siliceous material of which 520 came from layer 5. Of these in layer 5, 323 had well defined bulbs of percussion. If these chips represent drill-point manufacture, this type of working must have been time consuming but economically important, given the size and flaking qualities of the points.

Fauna and Flora

FISH

A large amount of fish bone was found in the site (Table 6). Identification was done mainly by sorting the best preserved head bones into species and counting the maximum number of one particular bone, e.g. snapper, left dentary. Leather jackets (*Novodon scaber*) were identified by their dorsal spines as were the northern spiny dogfish (*Squalus blainvillii*). One complete bag of fish bone from layer 5 was checked as a sample of the bone range and vertebrae from flounder (*Rhombosolea* sp.) were identified (no head bones were found as they are probably too fragile to survive in a midden). The small collection of layer 6 fish bone was also investigated and flounder vertebrae were present.

Table 6. Minimum number of fish in each layer and their percentage of site total.

SPECIES	Layer 3b No.	%	Layer 4 No.	%	Layer 5 No.	%	Layer 6 No.	%
Snapper (*Chrysophrys auratus*)	9	6.71	16	11.94	38	28.35	—	
Leather jacket (*Novodon scaber*)	4	2.98	6	4.47	21	15.67	—	
Butter fish (*Coridax pullus*)	2	1.49	4	2.98	6	4.47	—	
Spotty (*Pseudolabrus celidotus*)	—	—	—	—	3	2.23	—	
Northern Dogfish (*Squalus blainvillii*)	—	—	1	0.74	3	2.23	—	
Trevalli (?) (*Caranx lutescens* ?)	—	—	—	—	2	1.49	—	
Flounder (*Rhombosolea* sp.)	—	—	—	—	1	0.74	1	0.74
Horse Mackerel (?) (*Trachurus* sp. ?)	1	0.74	—	—	1	0.74	—	
Parrot fish (*Pseudolabrus* sp.)	1	0.74	5	3.73	1	0.74	—	
Barracouta (*Thyrsites atun*)	—	—	—	—	1	0.74	—	
Hapuka or Kingfish (*Jordanidia solandri* or *Polyprion oxygeneios*)	1	0.74	—	—	1	0.74	—	
Kahawai (*Arripis trutta*)	—	—	1	0.74	1 (?)	0.74	—	
Porcupine fish (*Allomycterus jaculiferus*)	—	—	—	—	1	0.74	—	
Unknown	—	—	—	—	1	0.74	—	
Unknown	—	—	—	—	1	0.74	—	
	—		—		—		—	
	18		33		82		1	

Snapper represented from between 45-50% of fish in each of the three main layers (3b, 4 and 5). Snapper is probably present in layer 6 but only tentatively identified from body bones. Leather jackets, representing from 18-25%, is the next most important fish followed by butterfish (*Coridodax pullus*) with from 7-12%. The only other fish to appear in all the layers is the parrot fish (*Pseudolabrus* sp.) with one example in layer 3b, five in layer 4 and one in layer 5 (Table 6).

A. B. Stephenson (pers. comm.) suggests that, allowing for sampling errors, impermanence of some types of fish bone and the problems of fish bone identification, the material in the site indicates line fishing rather than netting.

For some of the smaller kelp feeders such as spotties (*Pseudolabrus celidotus*) a drop net such as suggested by Law (Law 1972, p. 48) could have been used. Law (ibid., p. 98) quotes Witter (Witter 1969, p. 51) as suggesting that leather jackets, having a small mouth, probably could not take the New Zealand Polynesian fish-hooks. Witter

goes on to say that he understood that these fish are hardly ever caught on small steel hooks .However, I have personally caught leather jackets on small to medium sized hooks (No. 2-4) in the French Pass area. A keen fisherman has stated to me that leather jackets can be easily caught near the surface, by spearing, in harbours and around jetties in parts of the South Island. It is interesting to note that Law's Harataonga midden site (N30/5) has a very similar collection of fish bones with snapper as the dominant species and leather jackets next (Law 1972, p. 98, Table 4).

Since Hot Water Beach is an ocean beach the catching of flounder there is not very likely but these fish could have been speared, trapped or netted in the Purangi River or the Whitianga estuary.

One tooth from the mako shark (*Isurus mako*) was found in layer 4 and one spicule from the porcupine fish (*Allomycterus jaculiferus*) in layer 5. The porcupine fish is a shallow water fish but as it is reputed to be poisonous its presence in the layer is interesting. Spicules from the same fish were also noted by Law (ibid., p. 98) in the Harataonga midden (N30/5).

The presence of large amounts of vertebral material and rib/spine bones suggests that fish were eaten on the spot rather than being dried and taken elsewhere. Of the main cultural layers layer 3b had the lowest weight of fish bone, 275 g, layer 4 was next with 552 g and layer 5 the most with 1,386 g.

The presence of kahawai (*Arripis trutta*), kingfish (*Jordanidia solandri*) and barracouta (*Thyrsites atun*) together with a lure shank in layer 5, and kahawai bones and a lure point in layer 4 indicate that trolling was carried out but lures were not a feature of the site and nor were the fish caught in this way. Local coastal and tidal harbour fishing, trapping and netting were probably more important than deep water fishing or ocean netting. It raises the question of how important canoes were to the various occupiers of the site. Most fish could have been caught from the rocks or hand netted.

BIRDS

Fish and birds were the major source of protein in the site. Fish, weight for size, produced the highest percentage of flesh but birds had a wider economic importance.

Bird flesh has longer keeping qualities than fish. This may be only twenty-four hours but in those days this time must have had a significance in terms of food preparation and distribution. Birds' eggs were gathered and eaten (unidentified pieces of egg shell were found in layer 3b) and the importance of bird bone for artifacts, awls, needles, fish-hooks, etc, needs no elaboration.

Although no archaeological evidence remains for the use of bird feathers for cloaks and decoration, it is unlikely that some use of bird feathers was not made considering the number of birds found. There are many references to the use of feathers, for example Banks (Beaglehole 1962, p. 15) talks of dogskin cloaks and "Some there were who had these dresses ornamented with feathers and one who had an intire dress of red feathers of Parrots, but these were not common." In a footnote Beaglehole states that the parrot was a kaka. At Hot Water Beach the kaka was one of the commonest birds represented, and it is possible that the red feathers were used for decoration.

Table 7. Numbers of birds by layer and habitat.

SPECIES	Common name	Layer 3b	Layer 4	Layer 5	Layer 6
Ocean/sea/coast					
Diomedea sp.	Albatross	—	1	1	
Thalassarche sp.	Mollymawk	1?	1?	1	
Eudyptula minor subspecies	Little blue penguin	1	3	5 (1*)	
Larus dominicanus Lichtenstein	Gull, black backed	—	—	1	
Pachyptila vittata	Prion, broad billed	—	—	1	
Pelecanoides urinatrix	Petrel, northern diving	1	—	1	
—	Petrel sp.	1*	1	2 (1*)	
Puffinus griseus	Shearwater, sooty	—	—	1*	
Puffinus gavia	Shearwater, fluttering	1	—	1	
Puffinus assimilis	Shearwater, Chatham Island	—	—	1	
Phalacrocorax carbo	Shag, black	—	—	1	
Phalacrocorax melanoleucos	Shag, little or white fronted	—	—	1	
Strictocarbo punctatus	Shag, spotted	—	—	1	
		—	—	—	—
		5	6	18	Pres?
Forest					
Apteryx australis mantelli Bartlett	Kiwi	1	1	1	—
Callaesas cinerea wilsoni	Wattled crow	—	2	4 (1*)	—
Cyanoramphus n. novaezelandiae	Parakeet, red fronted	—	1	2	—
Hemiphaga novaeseelandiae	Pigeon	—	1	2	—
Heteralocha acutirostris	Huia	—	—	1 E	—
Nestor meridionalis septentrionalis	Kaka	3	5	10	—
Ninox n. novaeseelandiae	Morepork	—	1	1	—
Prosthemadera n. novaeseelandiae	Tui	1	1	6 (1*)	—
Turnagra capensis	Thrush (native)	—	—	1	—
Passeriformes	Unidentified small birds	?	?	Pres.	—
Strigops habroptilus	Kakapo (No layer but presesnt in site)	?	?	?	?
		—	—	—	—
		5	12	28	?

Lake/river/swamp					
Palaeolimnas chathamensis, Forbes	Coot (Extinct)	—	—	1 E	
Anas sp.	Duck/teal	1	—	Pres. (*)	
		—	—	—	—
		1	—	2	Pres?
Open country					
Circus eyles N.I. subspecies	Hawk (Extinct)	1 E	—	—	
Falco novaeseelandiae Gmelin	Falcon	—	1	1	
Gallirallus australis	Weka	—	1	3 (1*)	
Gallirallus minor	Little woodhen (Extinct)	—	—	1 E	
		—	—	—	——
		1	2	5	Pres?
Moa					
Dinornis sp.	Dinornis moa	Pres?	Pres?	Pres (1*)	Pres?
Euryapteryx sp.	Moa, small	Pres?	Pres?	Pres.	—
Euryapteryx exilis	Moa, small	Pres?	Pres?	Pres (1*)	—
Euryapteryx curtis?	Moa, small	?	?	Pres?	1*
Pachyornis mappini? Archey	Moa	?	?	?	?
Moa, unspecified		Pres.	Pres.	Pres.	Pres.

Key

1*	=	immature bird.
2 (1*)	=	immature bird, included with total.
1?	=	either albatross or mollyhawk but probably as indicated.
E, next to a number	=	Extinct.
Pres.	=	present but number and species not identified.
Pres?	=	identification not fully established.
?	=	disturbed material, could be from any layer.

Banks also notes (ibid., p. 13) that ". . . the most disgustingful thing about them is the Oil with which they daub their hair; this is melted from the fat of either fish or Birds . . ." suggesting that bird fat had a cosmetic use as well.

Banks' observations refer to people some hundreds of years later than the people responsible for the cultural layers 4 and 5. His remarks may not necessarily be applicable to an earlier period but it seems reasonable to assume that elements of these traditions might already have been present. There is direct evidence in the site of some use of the kaka other than food, in the worked bone described above (p. 46).

Twenty-nine named species of birds were recorded in the site (Table 7), moa being counted as one species because of the problem of identification (tentative identification of moa by species is given in Table 7). Passeriformes and other small birds are not included in the species count, although they were present in layer 5 and possibly in layers 4 and 3b.

Twenty-seven of the 29 species were represented in layer 5. The twenty-eighth, the extinct hawk (*Circus eyles*), occurs only in layer 3b, and the kakapo (*Strigops habroptilus*) came from the disturbed material. Fourteen species were represented in layer 4 and 11 in layer 3b.

Table 8 shows the numbers, habitat and percentages within each layer and Table 9 the numbers and percentages between the layer numbers and the total number of birds in the site. Although the presence of moa is noted in the two tables, moa is not included in the total and percentages of birds in the site. Forest birds form the

Table 8. Bird numbers, habitat and percentages for each layer.

	Layer 3b		Layer 4		Layer 5		Layer 6
	No.	%	No.	%	No.	%	
Sea birds	3	30.00	6	30.00	18	33.96	—
Lakes/rivers/streams	1	10.00	—		2	3.77	—
Open country	1	10.00	2	10.00	5	9.43	—
(Moa)	Pres.		Pres.		Pres.		Pres.*
Forest	5	50.00	12	60.00	28	52.83	Pres.?
	10		20		53		Pres.

* The presence of moa in every layer is not counted as a number in the above lists.

Table 9. Bird numbers, habitat and percentages for whole site.

	Layer 3b		Layer 4		Layer 5		Layer 6
	No.	%	No.	%	No.	%	
Sea birds	3	3.61	6	7.22	18	21.69	—
Lakes/rivers/streams	1	1.20	—	—	2	2.40	—
Open country	1	1.20	2	2.40	5	6.03	—
(Moa)	Pres.*		Pres.*		Pres.*		Pres.*
Forest	5	6.03	12	14.45	28	33.73	Pres.?
	10		20		53		Pres.

* The presence of moa in every layer is not counted as a number in the above lists.

largest group followed by sea birds. Two shag species (*Phalacrocorax carbo* and *P. melanoleucos*) have been included in the ocean/sea coast list. They could equally well have been placed in the lake/river habitat, as they may be found both coastally or inland. The inclusion in either category does not change the order mentioned above, although it changes the percentage slightly, so the numbers given in the tables under certain headings are a guide only.

The method used in establishing the minimum numbers of bird species present was as described by Law (1972, p. 96).

Immature birds

Of the eight immature birds present in the site, excluding moa, all except one were found in layer 5 (Table 7). Most of the birds nest in late spring or early summer (September, October, November).

The sooty shearwater or mutton bird (*Puffinus griseus*) nests later than most, hatching mostly in late January with the young leaving in late April or early May (Falla et al. 1970, p. 42). The weka can have more than one clutch in a season with eggs laid from September to April (ibid., p. 106).

Although there are a number of immature birds in layer 5, more remains are mature, so that although this cultural layer was certainly occupied in the spring and summer there is nothing to suggest that it did not continue into a winter season, if not longer. There are not enough immature remains to suggest concentrated gathering of certain species and their preservation. Many of the bones identified were body bones (e.g. corocoid, vertebra, femur). The evidence leans towards birds being eaten on the spot rather than preserved.

Distribution by layers

Layer 3b contained the fewest bird species (eleven species) excluding the moa and there are equal numbers of land and sea birds. In the other two cultural layers there is greater emphasis on forest birds and then on sea birds. It is interesting to note that bird bone weights in layer 3b drop very little below that of layer 4 (Tables 10, 11), although the number of species drops in layer 3b. The kaka is the dominant bird, as it is in all layers. One extinct bird, the hawk (*Circus eyles,* N.I. subspecies) is present which is not found in any other layer.

Table 10. Bird bone weights and percentages for each layer.

	Layer 3b		Layer 4		Layer 5		Layer 6		Total
	g	%	g	%	g	%	g	%	g
Bird bone	161	89.94	170	43.92	671	45.33	2	20	1004
Moa	18	10.05	217	56.07	809	54.66	8	80	2056

Table 11. Bird bone weights and percentages for whole site.

	Layer 3b		Layer 4		Layer 5		Layer 6		Total
	g	%	g	%	g	%	g	%	g
Bird bone	161	7.83	170	8.26	671	32.63	2	0.09	1004
Moa	18	0.87	217	10.55	809	39.34	8	0.38	2056

In layer 4 more bird species (14 species) are present, and forest birds are dominant. The pattern is similar to that of layer 5, the greatest numbers of birds come from the forest, next come sea birds, then open country and finally river and swamp birds. Kaka are the commonest birds followed by the little blue penguin. The rest are represented by only one or two individuals.

Moa bone is still present in layer 4, mainly as industrial bone, but a toe bone from *Euryapteryx* (probably *E. exilis*) found in square M 10 and a vertebra fragment from square M 12 suggest that the moa may still have survived in the area at the time of the layer 4 occupation. R. Scarlett (pers. comm.) refers to one piece as being obviously fossil bone. This might indicate that avenues other than fresh bone were being exploited because of scarcity of these birds.

Layer 5 contained the greatest number of species (27 species), the greatest number of birds and the greatest weight of bone. Forest birds were best represented and sea birds next. There is a minimum of ten kaka and five little blue penguin and a number of tui and wattled crow are present (Table 7).

The little blue penguin breeds all along the Coromandel coast. Young, inexperienced birds are often cast up exhausted or dead along the shore after storms or prolonged rough weather. This might account for some of the number.

Shags are common along the coasts and estuaries and the petrels and shearwaters could have been taken during the nesting period. Also petrels are apparently flightless during a short period of moult (Falla et al. 1970, p. 57).

Considering the land forms around the site and the presence of rivers and swamps in the environs there are surprisingly few swamp birds, especially duck, when, during late summer, they may be more easily caught during their moult. Other bird evidence suggests that the site was probably occupied at that season.

Of the now extinct birds (apart from the moa, which, if a viable species at that time, would probably have been found along the estuarine river flats and in the lower hinterland of the Whitianga area) one bone from the extinct coot (*Palaeolimnas chathamensis,* Forbes) was found in layer 5 and the little extinct woodhen *(Galliralus minor*) and the huia (*Heteralocha acutirostris*) were also hunted.

Both adult and immature weka were caught and the tui (*Prosthemadera n. novaseelandiae*) and wattled crow (*Callaesas cinerea wilsoni*) were well represented. A number of small unidentified birds, mainly passeriformes, indicated that a wide range of bird trapping, snaring and hunting occurred.

Moa was represented in layer 5 by *Euryapteryx exilis* in slightly sub-adult form together with bone from an immature bird of *Dinornis* species. *Dinornis* and *Euryapteryx* in adult form were also present but not identifiable as to species (Table 7). Most bird bone in layer 6 was moa. One piece of moa right tibio-tarsus from a small immature bird, probably *Euryapteryx curtis,* was identified and possibly some fragments were of *Dinornis* sp. Other bird bone was fairly fragmentary.

SHELLFISH

Shells were scattered throughout the layers rather than in concentrated heaps, except for the mud snail (*Amphibola crenata*). Several collections of 30-40 of these shells were found, mainly in layer 5 although they were scattered throughout the layers as well. A total of 5114 whole shells were counted, representing 16 species (Table 12) (bivalves were sorted into right and left valves and the maximum number of one side taken to represent the whole animal). Other species were present in ones or twos but were not included in the tables because they were not economically important. Broken shells have been excluded except for mussel (*Perna* spp.) and paua (*Haliotis* sp.). As these were always in a fragile condition they were sorted by hinges or rims. Only two valves of the oyster (*Ostrea* sp.) were found, one of these in the disturbed area and one in layer 5 in a very decayed condition. They were included in the "not economically important" numbers. Kino or sea urchin (*Evechinus chloroticus*) and scallop (*Pecten novaezelandiae*) were present. Kina was always in broken bits as might be expected from present day methods of eating the shellfish. Paua (*Haliotis* sp.) was found only in layer 5. The most common species throughout the site, except for layer 4, was the cats-eye (*Lunella smaragda*). The opercula of the cats-eye were used for the count as they were best preserved, many of the cats-eye shells being damaged and therefore not counted. Cats-eye counts represent 7.41% in layer 3b. The number drops to 5.12% in layer 4 and rises to 30.91% of the total shells in the site in layer 5 (Table 12).

Table 12. Numbers of shellfish and percentages of site total.

SPECIES	Layer 3b No.	%	Layer 4 No.	%	Layer 5 No.	%	Layer 6 No.	%
Rocky shore								
Lunella smaragda	379	7.41	262	5.12	1581	30.91	3	0.05
Haustrum haustorium	28	0.54	18	0.35	40	0.78	—	—
Neothais scalaris	7	0.13	1	0.01	4	0.07	—	—
Cellana radians	80	1.56	22	0.43	363	7.09	3	0.05
Cellana denticulata	6	0.11	8	0.15	45	0.87	—	—
Cookia sulcata	3	0.05	4	0.07	10	0.19	—	—
Haliotis sp.	—	—	—	—	8	0.15	—	—
Nerita melanotragus	124	2.42	90	1.75	206	4.02	7	0.13
Zediloma sp.	41	0.80	33	0.64	83	1.62	2	0.03
Perna spp.	1	0.01	7	0.13	37	0.72	—	—
Evichinus chloroticus	Pres.	—	Pres.	—	Pres.	—	—	—
	669		445		2377		15	
Sandy shore/mud flat								
Amphidesma australe	45	0.87	199	3.89	153	2.99	1	0.01
Amphidesma subtriangulatum	84	1.64	5	0.09	11	0.21	—	—
Chione stutchburyi	5	0.09	6	0.11	7	0.13	—	—
Amphibola crenata	59	1.15	459	8.97	572	11.18	2	0.03
Pecten novaezelandiae	Pres.	—	Pres.	—	Pres.	—	—	—
	193		669		743		3	

Of the sandy shore/mud flat species the mud snail in layer 3b represents 1.15% of the site total, 8.97% in layer 4 and 11.18% in layer 5. Although there is a low percentage in layer 3b the total number of shellfish also drops in that layer so that

comparison within the layer makes it more significant. As mentioned previously, the focus of layer 3b was probably not within the area excavated but if the material excavated does provide a representative sample of the activities, changes are suggested. It could also be argued that shellfish gathering was not so important in layer 3b because other food sources, e.g. agriculture, had become more important.

Pipi and tuatua (*Amphidesma* sp.) and cockle (*Chione stutchburyi*) form a very small percentage throughout the site, although the number of tuatua increases to eighty-four in layer 3b from the five represented in layer 4 and eleven in layer 5. The increase of tuatua in layer 3b may be significant. These shellfish are open beach rather than estuarine and although they are included amongst the sandy shore/mud flat category their habitat places them in an intermediate position between estuarine and rocky shore and nearer rocky shore for gathering purposes.

Big limpets (*Cellana* sp.) are present in all layers but they are fewer and tend to be smaller in layer 3b. Layer 4 is rather similar to layer 3b but in layer 5 the pattern changes. *Cellana radians* is very important (see Table 12), *Cellana denticulata* is less important but the majority of shells are very big, one measuring 7 cm across.

Tables 13 and 14 show the relative percentages of rocky shore/sandy shore and mud flat shellfish according to their habitats. It is interesting to note that layers 3b, 5 and 6 show a preponderance of rocky shore shellfish but in layer 4 the emphasis is on sandy shore/mud flat species. Although the cats-eye is important in layer 4, the two dominant shellfish are the mud snail and the pipi.

Table 13. Numbers and percentages of shells according to habitat for each layer.

	Layer 3b		Layer 4		Layer 5		Layer 6	
	No.	%	No.	%	No.	%	No.	%
Rocky shore	669	77.61	445	39.94	2377	76.18	15	83.33
Sandy shore/mud flats	193	22.38	669	60.05	743	23.81	3	16.66
	862		1114		3120		18	

Table 14. Numbers and percentages of shells according to habitat for whole site.

	Layer 3b		Layer 4		Layer 5		Layer 6	
	No.	%	No.	%	No.	%	No.	%
Rocky shore	669	13.08	445	8.70	2377	46.48	15	0.29
Sandy shore/mud flats	193	3.77	669	13.08	743	14.52	3	0.05

On the basis of the sixteen species represented in any quantity, layer 3b occupation people were exploiting the shellfish environment in a ratio (rocky shore/sandy shore, mud flat) of 3 : 1. Layer 4 produced a ratio of 2 : 3 and layer 5, 3 : 1.

Changes in sea shore shellfish gathering, especially in layer 4, could be due to over-exploitation of the rocks during the layer 5 occupation, forcing the exploitation of a different environment by the layer 4 occupation people and the return to sea shore species later during the 3b occupation.

The dominant species of shellfish in layers 3b and 5 is the cats-eye (*Lunella smaragda*). In layer 4, however, it is the mud snail (*Amphibola crenata*) that forms the majority of shells, although the second most important shell is the cats-eye. Generally speaking the cats-eye represents a steady and reliable food source throughout the occupation of the site. As with the limpets, however, the largest shells of the cats-eye were found in layer 5.

Of the total shells (5114), 68.55% (3506) represent rocky shore shellfish and the remaining 31.44% (1608) are sandy shore/mud flat species.

MAMMALS

Dog

These were present in all layers, although in layers 3b and 6 only immature bone was present.

The bone found in layer 3b came from a newly born or unborn pup. It showed signs of having been gnawed (agent unknown) but if chewed by a dog would probably have been more damaged than it was.

Layer 4 contained at least one adult and one immature dog.

Layer 5 had a minimum of four adults and a number of immature bones including at least one puppy.

J. Allo (pers. comm.) states that there was a minimum of six atlas vertebrae and six dog skulls but does not specify from which layer they came. She suggests that one of the skulls was broken at the frontals, probably for the extraction of the brain for consumption.

It would be interesting to know what the dogs fed on, as, apart from the gnawed pup bone in layer 3b, there is nothing to suggest that, in general, discarded bone was available for dogs. Fish bone seems to be a possibility but free roving dogs should have left some gnawing evidence on other bone material.

Concentrations of coprolites were found in layer 5, especially in squares M 11 and M 12. This could indicate the tethering of dogs but Allo (pers. comm.) suggests that it is common for semi-wild dogs to defecate in certain areas from choice, so coprolite collections do not necessarily mean tethering.

Seal

Seal bones were identified in all layers. The majority are probably from the southern fur seal (*Arctocephalus fosterii*) but the bones have not been fully identified.

The three main cultural layers all produced at least one adult and one immature animal. Layer 6 contained part of an atlas vertebra of a seal.

The fur seal whelps between about January and March and the pups could be caught any time between then and the following summer, but, depending on their maturity, pups could represent an autumn seasonal activity for layers 3b, 4 and 5.

Whale

An ear bone and some bone fragments of a small whale were found in layer 5. Some fragments were also found in the disturbed material.

Rat (Rattus exulans)

Rat bones were found in the three main cultural layers. Layer 3b provided evidence of at least one individual and layer 4, two. Only limb bones were present in these two layers. Layer 5 contained a minimum of ten rats (ten right femurs). There were also seven left mandibles and numerous cranial and body bones.

There is evidence of possible rat gnawing on a few bones from layer 5 but none in layer 4 and only the one gnawed (agent unknown) dog bone in layer 3b. Rats may have been scavenging during the deposition of layer 5 and died in the area, as well as being used for food, but the absence of head bones in the other two layers makes natural death unlikely.

Man

No human bone was found in the site.

LAND SNAIL SHELLS

Two types of land snail shells were found in the site, a small *Phenacohelix* species and the larger carnivore, *Rhytidia greenwoodi*. Most of the shells were in a very fragile condition and the total count (73) includes only the complete shells. Damaged ones were discarded. Both species are forest dwellers (A. W. B. Powell, pers. comm.), being present in light coastal forest and scrub. They require vegetation dense enough to be permanently damp throughout the summer.

Both species were found in large numbers in layer 5 (66) but the numbers drop off considerably in layers 4 (3) and 3b (2).

Layer 6 (as already mentioned) was an insignificant part of the excavation, although it could well have represented the outer edge of an extensive occupation. Snails (2) were present and considering the numbers in layer 5 which sealed it, forest must have been associated with layer 6 as well as layer 5.

The numbers of snails in layer 5 indicates that the site, at that time, was amongst, or very close to, heavy scrub or forest. The smaller numbers in the later layers is possible evidence that bush had retreated from the site, because of burning or felling, or both. The absence of charcoal even as ash in the excavated portion of layer 5 and the presence of numerous land snails indicates that the activities carried on at that time were on the edge of, if not amongst, the trees.

REPTILES

The right and left femur of the tuatara (*Sphenodon punctatus*) were found in layer 5, probably from the same animal.

INSECTS

Square M 11, layer 5, produced fragments of a sand scarab (*Pericoptus* sp.) which is probably sub-fossil. Because of the depth it was found and its appearance it could possibly be from the layer 5 occupation time (K. A. J. Wise, pers. comm.). It is usually found along sandy coasts, often under driftwood or logs above high water.

Miscellaneous

SEEDS

Two small rounded yellow/brown seeds were found, one in square M 11, layer 5, and the other in square L 11, layer 3b. They were both seeds from a convolvulus (*Calystegia* sp.), which is a dune plant, although it grows in other areas. Similar seeds were found in archaeological material from Lake Mangakaware (J. Goulding, pers. comm.).

IRON

A small piece of very rusty iron was found in square M 11, layer 4. It is presumed to be a rusty nail and to have fallen into the square from the surface during excavation. There were also two fragments of iron of a similar nature from layer 3b, square L 11.

Discussion

PUMICE

Although there was a lot of pumice scattered throughout the site it was the presence of a grey water-worn pumice in heavy concentrations in layer 5, later identified as Loisels pumice (H. W. Wellman, pers. comm.), that was particularly interesting. This Loisels pumice has been assigned a more recent carbon 14 age than the approximate A.D. 700 originally suggested by Wellman (1962, p. 29).

Wellman now states that the pumice shower seems considerably later and probably about A.D. 1300 (Wellman, pers. comm. 1970). Assuming that the pumice shower is now dated fairly accurately, its presence in the site makes it a time marker for the deposition of layer 5, which must have commenced fairly soon after the explosion shower, as in places, square M 11 for example, the pumice rests either on sterile sand or immediately above layer 6 in concentrated layers. Layer 5 overlies this without any indication of a time lapse, although the fact that the pumice is water rolled and sea deposited must imply some time between the explosion and the deposition of the pumice on the beach.

Although there is no carbon 14 date for layer 5, the Loisels pumice evidence places layer 5 as some time not too long after A.D. 1300.

Layer 3b had a sparse amount of Loisels pumice well scattered throughout the layer. Other sea-washed pumice was also present, but not in any quantity.

Layer 4 contained Loisels pumice in considerable quantities but nowhere did it occur in well defined pockets, and, as with layer 3b, it was scattered throughout the layer in a random fashion. There were also numerous pieces of rusty orange and blackish pumice, generally larger than the Loisels type, which probably came from the central North Island zone (B. P. Kohn, pers. comm.).

Apart from the large deposits of Loisels pumice in layer 5, other pumice was also present, especially large and small pieces of the Taupo type; a piece of blackish pumice foreign to the central North Island volcanic zone (it may have originated from the Auckland volcanic centre or from the Kermadec-Tonga group) and a dark brittle glassy pumice of unknown origin (B. P. Kohn, pers. comm.).

Only two pieces of Loisels pumice were found in layer 6 and these were probably accidental intrusions from layer 5. Its presence was not noted in square L 10 where the layer was better defined. No other pumice was found in the layer. Although layer 6 was erratic in its distribution, the apparent lack of Loisels pumice suggests that the layer was deposited before A.D. 1300.

ARTIFACTUAL AND MIDDEN MATERIAL COMPARISONS

Two other sites have similar deposits of Loisels pumice, N40/3, the Opito Beach site, and N30/5, the Western midden at Harataonga Bay, Great Barrier Island.

In the Opito N40/3 site the significance of Loisels pumice was not realised in the 1957/58 excavation, although its presence was noted. The following year further work was done to establish its position in the cultural layers. "Pumice was found at all levels but material that could be described as 'black', or even 'gray' as opposed to 'white' did not appear below a certain level in the sequence, stratigraphically the upper half of the sand layers dividing the two cultural horizons at the base of the deposits" (Golson 1959a, p. 18). This sand layer dividing the two main cultural layers has been further defined as layer 4b by Green in his summary (Green 1963, pp. 59-60).

Layer 4b must have contained some cultural material as Green (1963, p. 60) suggests that obsidian dates make 4b younger than 4c. Layer 4c, which contains no Loisels pumice, has a radiocarbon age reported as A.D. 1310 $\pm$ 50. The upper part of layer 4b at Opito and layer 5 at Hot Water Beach would thus be contemporary and have been deposited some time soon after A.D. 1310 $\pm$ 50. (This date is uncorrected for the new half life or secular effect.)

It is unfortunate that there is no list of artifacts from layer 4b specifically mentioned in the literature. Material from layers 4c, 4b and 4a is discussed by Golson (1959b, pp. 44-45). The general list included moa skeletal bones, industrial moa bone, moa egg-shell, adzes of Duff types 1A, 2A, 3A and 4A, one-piece fish-hooks, an unperforated lure hook point, shell copies of shark tooth necklace units, bird bone tube, *Dentalium nanum* and shell necklace units. It is interesting to note the variety of threaded ornaments present in both the Opito and Hot Water Beach sites. No "reel" units were found in N40/3.

Loisels pumice was also found in the lower part of the midden N30/5 at Harataonga Bay, Great Barrier Island (Law, 1972). Various problems make association of specific artifacts with the pumice layer difficult but Law suggests that it is possible to consider the midden as representing a single occupation.

Amongst the artifacts found in N30/5 were several portions of Opito, Type 1, moa bone fish-hooks, a lure shank of Crosby's early grooved series (surface find), a single perforated shell lure point, a fine but broken bone needle, a tattooing chisel, part of a bird bone spear, several roughouts, drill points, files and four *Glycymeris laticostata* shells that may have been used as necklace units.

Shellfish in N30/5 was mainly rocky shore type with a few mud flat/tidal estuary species. *Amphibola crenata* (mud snail) was absent. Seal and dog remains were present as well as one species of moa, probably *Euryapteryx geranoides.* (The presence of moa on the island has not yet been fully established so that the moa material may have been imported from the mainland.)

The other birds in the site were, on the whole, similar to those at Hot Water Beach, and show that *Eudyptula minor* (sub-species), the little blue penguin, and *Nestor meridionalis septentrionalis,* the North Island kaka, were better represented than other species in both sites. However, *Macroptera gouldi* Grey, the grey-faced petrel (the traditional North Island mutton bird) was exploited at Harataonga Bay but not represented at all at Hot Water Beach. Comparisons between the fish species of layer 5 at Hot Water Beach and those of the Harataonga midden N30/5 have already been made (see above, p. 59).

The similarities between the three known sites containing Loisels pumice suggests that a generalised adaptation to the exploitation of the environment of the Coromandel - Great Barrier Island - East Coast was already well established by about A.D. 1300 and that there was little differentiation between the cultural adaptations in the three sites.

RADIOCARBON DATES

The first series of radiocarbon dates from layer 4 (N.Z. 1169-1171) has been published (Leahy 1971, p. 63). N.Z. 1169 and N.Z. 1170 were charcoal, while N.Z. 1171 was grease extracted from the same sample as N.Z. 1170. Because of the discrepancy between the two dates from the same sample, the Institute of Nuclear Sciences tested further samples from the same layer (N.Z. 1296, *Amphibola crenata* shells, N.Z. 1297, *Amphidesma australe* shells, and N.Z. 1298 and 1299, fish bone carbonate and organic fraction from fish bone respectively).

Sample N.Z. 1298, the fishbone carbonate, produced a modern date. The very recent result provided by N.Z. 1171 and the modern result of N.Z. 1298 have not been included in the dates below because their assessments do not conform to the other evidence. However, all results are set out in Table 15.

If all the remaining results are considered, at one standard deviation, a date in the range between A.D. 1350 and 1540 is quite acceptable for layer 4, with an age earlier than A.D. 1390 considerably less likely.

Table 15. Carbon dates from site N44/69.

Lab. No.	$\delta^{13}C$ w.r.t. PBD	$\triangle^{14}C$ w.r.t. 0.95 Oxalic Acid	^{14}C age w.r.t. Oxalic Acid (5568 half-life, uncorrected for secular effects)	CALENDRICAL AGE IN YEARS B.P. Following laboratory advice the best result, calculated by using new half-life, appropriate standards, and corrected for secular effects
N.Z.1169	— 24.8°/oo	— 54.2 ± 4.9°/oo	421 ± 40	457 ± 50
N.Z.1170	— 24.9°/oo	— 61.0 ± 9°/oo	484 ± 79	501 ± 89
N.Z.1171	— 27.7°/oo	— 25.0 ± 9°/oo	177 ± 77	245 ± 77
N.Z.1296	+ 1.2°/oo	— 94.1 ± 4.8°/oo	453 ± 40[1]	470 ± 50
N.Z.1297	+ 1.2°/oo	— 102.0 ± 4.8°/oo	524 ± 40[2]	557 ± 50
N.Z.1298	— 4.3°/oo	+ 10.0 ± 12°/oo	modern[3]	modern
N.Z.1299	— 13.9°/oo	— 79.0 ± 9°/oo	325 ± 78[4]	417 ± 88

[1] $\triangle^{14}C$ w.r.t. N.Z. Marine shell standard: — 57.3 ± 4.8°/oo
[2] $\triangle^{14}C$ w.r.t. N.Z. Marine shell standard: — 65.6 ± 4.8°/oo
[3] $\triangle^{14}C$ w.r.t. N.Z. Marine standard: + 51.0 ± 12°/oo
[4] $\triangle^{14}C$ w.r.t. N.Z. Marine standard: — 42.0 ± 9°/oo

Thus an age in the 15th century is to be preferred for layer 4.

This is consistent with the recovery of Loisels pumice throughout layer 5 and the reassessment of the date of the eruption at approximately A.D. 1300. Layer 5 was almost certainly formed after A.D. 1300 as the pumice itself is weathered and water-worn in the layer. This gives a *terminus post quem* for the main occupation layers of the site so that layers 5 and 4 were formed between approximately A.D. 1300 and A.D. 1540 with a reasonable assumption that layer 5 accumulated in the 14th century.

Conclusions

Excavations at Hot Water Beach showed that there were three main occupation layers, layers 5, 4 and 3b. Layer 6, although separated by time from layer 5 and of an indefinite nature, was similar to layer 5 in content.

Evidence from layer 5 occupation indicates that the site was situated on the dune flats above the stream mouth and ocean beach. The presence of numerous land snails in the layer suggests that the coastal bush must have been close to the stream and beach edge and that the site was partly within this bush.

Layer 5 adzes and roughouts appear to be Archaic in style but not clearly defined as to type, except for the side hafted adze. Stone working was important. The basalt flake material suggests adze finishing rather than initial block shaping as the flakes were generally not large. The main quarry for basalt was to the north, at Tahanga, on the south end of Opito beach. This basalt source was used throughout all the layers. The large number of basalt flakes suggests that adzes were finished at the site but used elsewhere, and the presence of a number of flakes showing polishing indicates that adzes were reworked as well as manufactured.

Numerous drill points were found in layer 5 and the presence of drilled bone and fish-hook manufacturing remains clearly show one of the uses. These drill points were probably used for wood working as well although there is no direct evidence for this. The larger basalt "hand-held" points would be too large for bone work and were more likely to have been for timber working, possibly for wooden structures, or canoe building as suggested by the presence of the side hafted adze.

Two or more sources of obsidian were used during the layer 5 occupation. Statistically the presence of more obsidian than might be expected is significant and a preference was shown for using flakes from the Mayor Island source over those from "other sources".

Fishing was mainly confined to inshore line fishing rather than extensive netting. Some trolling occurred. Canoes, if present, were probably for general purposes, transporting of people and goods, bird hunting on off-shore islands, and other seasonal occupations, as well as fishing.

Rocky shore shellfish are dominant, especially cats-eyes (*Lunella smaragda*), and as these shells did not appear burnt or deliberately broken, they may have been boiled in the hot spring or steamed in a hangi to facilitate the removal of the flesh from the shell.

Moa was probably hunted and the bones used to manufacture ornaments and tools. Moa bone was also used for fish-hooks but there is little evidence for the preparation of tabs on the site. It is possible that these may have been prepared elsewhere and brought to the site.

Bush birds were the most important species in layer 5, followed by sea birds. The kaka especially seemed to be of economic importance not only for food but for other purposes such as bone artifacts and possibly for feathers.

A number of ornaments, especially threaded items, were present either completed or in the process of manufacture. The possible tattooing chisel suggests that tattooing was practised and hair combs may have been used.

Material from layer 5 shows that there was a wide and efficient exploitation of the environment. Local stone was used extensively, and trading and exchange patterns or political affiliations were evident by the presence of obsidian from various sources, and the Tahanga basalt material.

Comparison with two other excavated sites containing Loisels pumice shows a number of similarities and indicates a fairly generalised adaptation to and exploitation of the environment by three different groups of people at that time. The presence of Loisels pumice in layer 5 suggests that the layer was probably deposited during the 13th century.

Layer 4 was similar in many ways to layer 5 but on a lesser scale. The layer generally consisted of a compact greasy black sand containing many ovens and fire pits. Associated with these were structures, possible cooking shelters or wind breaks. There were few land snails in the layer, suggesting that the bush was not near the occupied area.

Adzes and roughouts were similar to layer 5. At least two sources of obsidian continued to be used. The number of pieces and their weight conformed to statistical expectations. No ornaments were found in the layer.

Kaka was still the most important bird and the fishing and trolling followed similar patterns to layer 5. Possibly a few moa were hunted but the presence of fossil bone could indicate that moa bone had become scarce. Shellfish tended to be of the mudflat or tidal estuary types although cats-eyes remained important. This switch in shellfish gathering may have been caused by over-exploitation of the coast, political changes opening up areas not previously available, or possibly a change in food preference.

No immature animals except the seal occur in this layer.

A series of carbon dates was obtained for material from layer 4. These suggest a probable 15th century date for the cultural deposit. Overall no obvious changes in subsistence patterns between layer 5 and layer 4 occur.

Layer 3b, as it appears in the site, suggests a more restricted exploitation of the environment. Probably no bush cover existed near the area. Hangi were present but

they were few and isolated. The numbers of birds present drop and shellfish exploitation shows change. There is little evidence for the presence of moa. One-piece Opito Type 1 fish-hooks disappear and the first shell hook occurs. No ornaments were found.

Drill points and stone flakes are reduced in number. The one adze roughout retains its Archaic character. Statistical evidence indicates a probable change in the pattern of obtaining and using obsidian although the use of both Mayor Island and "other sources" continues.

No indications of structures were found in layer 3b except for one pit which could suggest some type of storage though no other evidence for agriculture is present.

A recent survey of some of the ridges behind the beach did not produce any signs of storage pits and the pa on the promontory above the site (N44/14), although showing well defined terraces and a double ditch and bank, did not have any obvious pits on the terraces.

The excavated site (N44/69) at Hot Water Beach represents a rather stabilised late manifestation of the Archaic period of New Zealand pre-history, particularly during the layer 5 and 4 occupation. Although layer 3b is similar in many respects certain changes are beginning to occur.

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